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The Electricity (Supply) Bill.

NEXT week Parliament will resume its sittings, and one of the first and most important matters for its consideration will be the Electricity (Supply) Bill, as reported to the House of Commons. In view of the enormous influence that this measure, if adopted, will exercise upon the future of electricity supply in this country, it is worth while to review the situation at some length.

As amended in its progress through the Committee stage, the Bill will set up a Board consisting of eight members, not elected, but appointed by the Minister of Transport for a period of at least five years. This Board will purchase electricity and resell it to authorised undertakers. The constitution of the Board is not analogous to that of the Metropolitan Water Board, the Port of London Authority, or any other elective body—like the Electricity Commission, it is a purely departmental body, an offshoot of the Ministry of Transport.

This Board will consider schemes submitted to it by the Electricity Commissioners for the performance of its duties, hold inquiries regarding them if it thinks fit, and modify them at pleasure; the only safeguard against the tyrannical exercise of the Board's wide powers—which involve the most arbitrary interference with the operation of the largest power stations by their owners—is a provision for reference to the arbitration of a barrister also appointed by the Minister of Transport, whose power can be restricted by the Board to the grant of pecuniary compensation.

The Minister of Transport may (but not without Parliamentary assent) bring about the compulsory purchase of a generating station if the owners will not carry out the orders of the Board to alter or extend it, and if no one can be found willing to act, the Board itself may be authorised to buy it and run it; or it may build and operate new stations—the Electricity Commissioners in the latter event taking the place of the Minister. On the other hand, when it is a question of a supply undertaker refusing to buy electricity in bulk from the Board, the Electricity Commissioners are empowered to close the recalcitrant station. Whenever such a bulk supply is available, it will have to be accepted unless the undertaker can prove that he can generate more cheaply for himself.

Now, these are very wide and drastic powers to entrust to a Board which is not responsible to anyone for its actions (the members of the Board are irremove-

able for at least five years, possibly ten). Moreover, the Board is empowered to raise loans aggregating no less than 33½ millions sterling, under Treasury guarantees, with which it may purchase or construct a huge system of interconnecting mains and carry out at great cost the standardisation of frequency in accordance with its schemes.

Granted that the Bill does not propose in so many words to "nationalise the electricity supply industry"—nevertheless it comes very near doing so, for it assumes control of a large proportion of the capital already expended and to be expended, besides incurring a large additional direct outlay. Electricity supply is to be, in fact, departmentalised.

Is there not still time to remove this grave objection by altering the constitution of the Board, so that it shall cease to be the mere appanage of the Ministry of Transport? With a nucleus of highly-paid and highly-competent officials (if such can be found), a body of voluntary representatives elected by the various interests concerned—as in the case of the Port of London Authority—would be free from the criticism of semi-nationalisation and would be much more likely to achieve results in accordance with reason and justice. Such a system has, in fact, proved admirably serviceable in France, to the satisfaction of all parties.

Turning from the administrative to the technical aspects of the Bill, we find that the criticisms which we have levelled at it remain unanswered and unrefuted. The scheme, founded upon the Weir Committee's report, is a gigantic experiment.

True, interconnection has been adopted to a limited extent both here and abroad, as a means to an end; it is useful within reasonable limits. For instance, the interconnection of hydroelectric with thermal generating stations, as in France or the United States, is a sound policy of established value—but we have no water-power calling for interconnection. Similarly, where fuel such as lignite cannot be transported, as in Germany, or waste-heat or water-power is to be utilised, transmission lines are obviously necessary, and they are efficient because they are adequately loaded; but we are not dependent upon such sources of energy—and where they are available they can be drawn upon, as in the north-eastern area, without covering the whole country with a "grid." Such, however, are the reasons for adopting long-distance transmission in the foreign countries which are mistakenly held up to us for examples. We repeat that in no country where conditions similar to ours obtain has a "grid" of mains been laid down; and in no country whatever is there a public authority which buys electricity wholesale and resells it to bulk customers for distribution. That is a huge experiment which has never been tried to this day. It will involve an unprecedented degree of interference with the operation, extension, disposition, and output of the "selected stations"—that is, the best large power stations of this country—to say nothing of an alarming amount of complicated accountancy to decide whether the price offered to the owners by the Board is or is not less than that at which the owners could have generated for themselves if the Bill had not been passed.

We have shown on previous occasions that the data on which the scheme is ostensibly based are gravely in error—even to the extent of comparing units *generated* abroad with units *sold* in this country, and setting-off the most highly developed areas in foreign countries against the average consumption of the whole of our population; the I.M.E.A. endorsed our contention that the data used by the Weir Committee were unreliable. Moreover, the energy generated by private industrial concerns for their own use was left out of account, though it is believed by the Electricity Commissioners to be not far short of that produced by the statutory undertakings. Hence, we are by no means so far behind other countries as the Government would have us believe. Our pages have shown, from time to time, that where the supply authorities have adopted a progressive and enlightened policy, extraordinarily rapid advances have been made under the existing conditions, without the help of a huge scheme of interconnection, and it has repeatedly been demonstrated that the cost of electricity in the industrial areas of this country compares favourably with the cost in other countries. As for the economy to be effected by the interconnection of widely separated areas, which in this country necessarily have very similar daily load curves, we have pointed out—and engineers of the first standing have pointed out—that there is little to be gained in this way. Long transmission lines cannot pay their way unless they are continuously loaded for many hours a day; as mere stand-by links they would be a very bad investment, and in this country, where in normal times coal is mined almost everywhere, it is exceedingly difficult for transmission lines to compete with local generating plant under any conditions of load factor. As for the wholesale standardisation of frequency, the cost of this is regarded by many of our leading authorities as certain to be far greater than the Government advisers estimate, and out of all proportion to the advantages that would result from the conversion.

But the electrical industry wants peace and freedom from the uncertainty which has already caused so much delay and hampered progress; if a Bill is not passed this winter, we shall be confronted with an indefinite prolongation of that uncertainty, and a new term will be granted to the obstacles which block our way. We must have a Bill of some sort, and there is still a possibility of amending the present Bill. What, then, should be done with it?

We should like to see the constitution of the Board improved, and the appointment of the members taken out of the hands of the Minister of Transport—so that, in accordance with the statement of the Prime Minister last January, it should *not* be a Government department.

We should like to see the powers of the Board to construct interconnecting mains limited to regional interconnection, and its powers to standardise frequency made subject to demonstration by public inquiry that the result would justify the outlay.

We should like to abolish the absurdity of buying from an undertaker all his output and reselling to him the energy he requires for his own undertaking.

We should like to see the proposals of the Advisory Committee on Domestic Electricity Supply with regard to tariffs, wayleaves, restrictions on overhead mains, and other matters which we have long advocated, embodied in the Bill, which in its present form does little to help the development of domestic and rural electricity supply.

We should like to see the facts looked squarely in the face and not smothered under a mass of erroneous data, unfair comparisons, and inconsequent deductions for the sake of a mere fetish. Then the electrical industry would have a chance to develop on sound lines.

The I.E.E. Presidential Address.

In his inaugural address, of which an abstract is concluded in this issue, Dr. Eccles struck out on unexpected lines, remote from the subjects with which his name has been most intimately associated. That is, of course, the privilege of a president. We wish, however, that he had refrained from drawing comparisons between the electrical progress of this country and that of others, based upon statistics which we are unable to regard as reliable, and without adequate recognition of the very different conditions which have prevailed in the respective countries, which render such superficial comparisons misleading.

It is true that Dr. Eccles admits the unsoundness of comparisons of consumption per head of population—but he immediately proceeds to repeat them; and similarly in connection with other tabulated data, he depreciates their value and describes them as unfair. Then why quote them?

Interconnection appears to be in his opinion the remedy for our poor showing in his tables—though he

points out that "the cost of transmission limits severely the region to which hydraulic power can be delivered cheaply," an argument which tells equally against the transmission of power from thermal stations; he agrees that it is cheaper to rail coal from South Wales to London than to transmit electricity. And yet, after admitting that the (average) inefficiency of our generating stations does not greatly increase the price of electricity, he returns to "the lack of interconnection or co-operation between generating stations" as "the chief cause of our delayed development.

Dr. Eccles makes it clear that he believes interconnection would improve load factor, though he does not explain how the combination of two or more precisely similar daily load curves is going to help towards that end. Our contention—and that of many of our leading experts—is that little benefit can be expected from that source. Improvement of the load factor is essential; but that is not the way to do it.

We have not space to-day to follow him through the many aspects of his address, but throughout, with some exceptions, there is a tendency to draw comparisons which are generally unfavourable to this country. Why should the president of the Institution of Electrical Engineers go out of his way to tell the world that Britain is played out? We remember one of his predecessors—Mr. W. M. Mordey—who struck a very different note—and we prefer the optimistic to the pessimistic vein.

Frauds in Trade.

FRAUDS of the "long-firm" type have been more frequent again lately. Those who suffer losses from this cause sometimes have the satisfaction of seeing the offenders brought to the bar of justice; but such satisfaction brings small comfort when goods cannot be recovered and losses are irretrievable. Yet one need not waste too much sympathy over those who neglect to take adequate business precautions when opening new accounts. In a case reported in our last issue it transpired that in many cases references were accepted without question, no investigation being made as to whether they were good, bad, or indifferent. Apparently traders are in such haste to accept orders and execute them that they have not time to ascertain what risks they are running. "A" executes at once a bad order for fear it shall pass on to "B," if he is too particular. The subject is not one calling for detailed discussion again; we have often dealt with it, but we report the proceedings of prosecutions so that electrical firms may be on their guard. There are the ordinary sane methods of doing business such as requiring cash with early orders, or the production of a bankers' reference, while the trade also has the opportunity for establishing a Trade Protection Society of its own, or, alternatively, availing itself of the general societies of that class, supplemented with the status investigation concerns which are so well known in the City. It is for the trade to protect itself, as far as it humanly can do so, but it has also to remember that, apart altogether from the individual bearing of the matter, there is the unquestionable fact that by ignoring risks and running a business on free and easy and lax lines we actually invite the nefariously inclined to carry on their operations, and to repeat them again and again after terms of imprisonment. Reduce the temptation and we may reduce the crime.

Progress in Illuminating Engineering.

THE opening meeting of the Illuminating Engineering Society, on October 26th, devoted as usual to a review of progress and the exhibition of lighting novelties, was calculated to give an impression of progress in the lighting field. The report, presented by Mr. J. Y. Fletcher, supplemented by numerous individual exhibits, was exceptionally comprehensive. Whilst there is perhaps no very radical departure in electric lighting to record, the advances in detail amount in the aggregate to substantial progress, one of the most striking features of which is the growing recognition that progress in the design of lamps and lighting appliances must be accompanied by instruction in the best methods of using them. There should be no need for us to emphasise the good work that is being done by the Lighting Service Bureau in this direction, and by the Illuminating Engineering Society, to which the Bureau extended its hospitality for this meeting. Whilst Mr. Fletcher's address was concerned primarily with practical developments in electric lighting, the wider and more scientific aspects of illuminating engineering were covered by Mr. L. Gaster's Report of Progress during the Vacation. It is often assumed that during the summer months the activities of societies are in abeyance. In this case, certainly the period has been well spent.

We have frequently emphasised the vital importance of experts in this country being kept in touch with progress in other countries. It is perhaps not generally known that besides the Illuminating Engineering Society in the United States, there are similar bodies in Germany, Austria, Hungary, and Japan. Holland has this year been added to the list of countries so equipped. In Germany, two off-shoots of the main society, in Karlsruhe and in the Westphalian district, also exist. We understand that one of the main objects of Mr. Gaster's tour abroad was to ensure that, by the exchange of transactions, we in this country should be kept in touch with all these foreign developments. Illuminating engineering is becoming an international subject. The need was never greater for this country to be represented by a vigorous Illuminating Engineering Society, adhering closely to the scientific and impartial methods on which its reputation has been built.

Identifying Broadcasting Stations.

MOST people who have listened to the Continental radio-telephone broadcasting stations know how exasperating it is to be "in the dark" as to the identity of a station. Every station has its allotted call sign, but frequently it is virtually discarded, and when it is used, the announcement is made in the national language only, being therefore unintelligible to the many listeners outside the country concerned. A few of the more experienced listeners may distinguish some of the chief European stations by certain characteristics of transmission and by the wave-length settings of condensers and coils, but this practice is not to be relied upon. What is needed is a simple method of identification which will enable listeners to recognise a station at once, a need that will become greater as the present wave-length situation in Europe becomes more stable, for interest in foreign stations will be stimulated by the greater ease with which they will be able to be heard.

It ought not to be difficult for some code to be devised whereby all stations could be quickly and easily identified; it would be desirable for each station, having its own symbol, to interpolate it frequently in the programmes, and it would therefore need to be quite short. The code might allot to each country some characteristic by which the nationality of the station would first be recognised: then would follow the station's symbol.

Something of this kind has been attempted, though in a small and unofficial way. Some of the French stations have been in the habit of commencing and concluding their programmes with a flourish on a trumpet, cornet, or horn; Swiss stations have used bells, and, in the case of our own stations and some of the Germans, "tuning notes" are transmitted by means of buzzers and the sustained notes of an organ. It should not be impracticable for each station in Europe to have its own distinctive symbol after this fashion, which would make the problem of identification both easy and interesting. Perhaps we may hope that when the International Bureau of Broadcasting at Geneva has finished unravelling the wave-length tangle, if indeed it ever succeeds in doing so, some attention will be given to this deserving subject.

Electricity Supply at Derby.

Recent Plant Extensions—The Adoption of Pulverised Coal.

THE County Borough of Derby inaugurated its first electricity works in 1894, generating single-phase alternating current. Following additions to the plant, a tramway system was opened in 1904, and advantage was taken of the extension of the electricity works necessitated thereby to install both d.c. and a.c. steam turbo-generators. A new three-phase generating station was completed in 1908 and extended in 1914, 1917, and 1922, whilst the most recent addition to the plant was inaugurated officially on October 26th, 1926.

Fig. 1.—Exterior of New Boiler-house.

The building covers an awkwardly shaped site (fig. 1), and ingenuity was required to design coal-handling plant to fit in the limited space available. The main contractors for the boiler house were Messrs. International Combustion, Ltd., and "Lopulco" pulverised-coal firing equipment has been installed; fig. 3 is a key diagram of the general lay-out of the plant. Coal is delivered by electric lorries, which tip it into a steel hopper, whence it passes to a bucket elevator capable of lifting 30 tons per hour at 120 ft. p.m., which discharges the fuel on to a short scraper conveyor that carries it to a 325-ton bunker at one end of the boiler house near the roof; one 15-h.p. motor drives the elevator which, in turn, drives the conveyor. This portion of the contract was carried out by the Ewart Chainbelt Co., Ltd.

Raw coal from the bunker is fed through a shoot into the drier, fig. 2 (or direct to the pulverising mills should it be of such a nature as not to require drying) of the rotary steam-heated type. It comprises an internal rotating cylinder carrying cast-iron tables arranged in series circumferentially and longitudinally, with coils cast in them to which steam is admitted through the hollow driving shaft, and drainage is effected in a similar manner through the bottom shaft. The raw coal entering the drier is projected on to a series of perforated tipping trays which rotate with the inner cylinder; after completing a revolution, the trays discharge the coal on to the first set of tables, where it is distributed into a uniform layer by means of a spreader fixed to the outer casing; on the completion of a second revolution, the coal is transferred to the next lower set of tables by a scraper, also fixed to the outer casing, the operation being repeated for each set of tables throughout the whole length of the drier. Finally, the dried coal drops into a hopper and is discharged into a bifurcated shoot which leads to the feed of either of two mills.

The vapour formed in the process of drying is carried off by air drawn partly from the return air between the

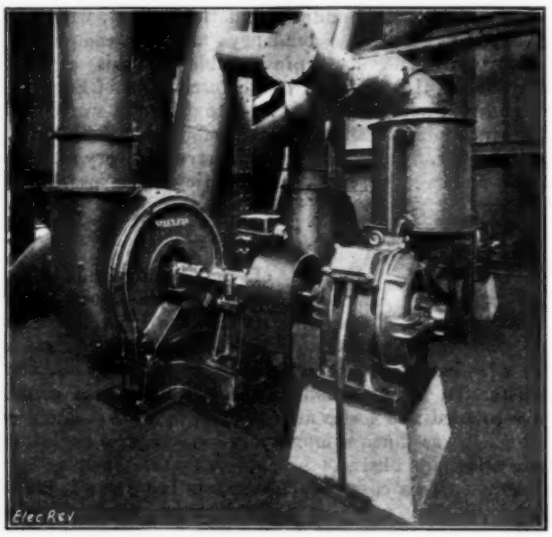


Fig. 2.—Drier and Exhauster Fans.

cyclones and the mills, and partly from a small steam coil air heater near the bottom of the drier. The air enters the drier at the bottom, circulates between the tables, and at the top passes through the perforations in the tipping trays on which the wet coal is fed to the drier, finally leaving by the top plate which is connected to the suction side of the fan; in this manner, by coupling the drier and the return air pipe, any excess air used in the pulveriser system is scrubbed by contact with the moist coal, and any coal dust remaining in

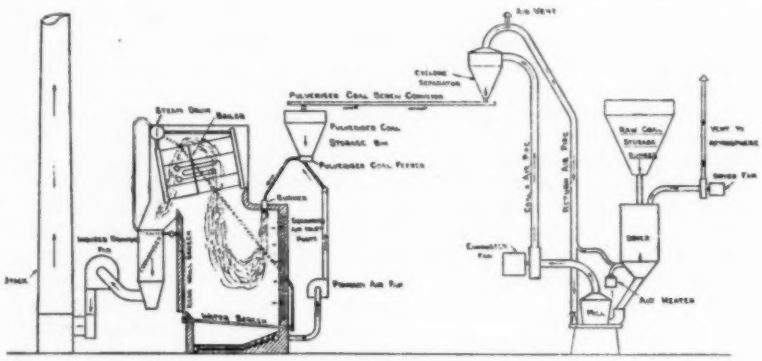


Fig. 3.—Arrangement of "Lopulco" Pulverised Coal Plant.

suspension is deposited before the air is discharged to the atmosphere. The drive is by electric motor, through reduction and bevel gears, accommodated on the top plate of the drier.

The Raymond mills, fig. 4, pulverise by rollers mounted pendulum fashion and maintained against a circular steel track by centrifugal force, the coal being fed between the fixed and rolling surfaces. A special

grease adaptor is provided for preventing the ingress of coal dust to the bearing surfaces and of oil to the grinding chamber. Attached to the spider and revolving with it are a number of ploughs, corresponding to the number of rollers; the function of the ploughs is to pick up the coal from the bottom of the mill and project it between the rollers and the pulverising track. The latter is made of special steel offering a high resistance to abrasive action, held in position by wedges which permit of its easy withdrawal. Attached to the bottom of the base is the completely enclosed gear box which accommodates the bevel driving gear and the

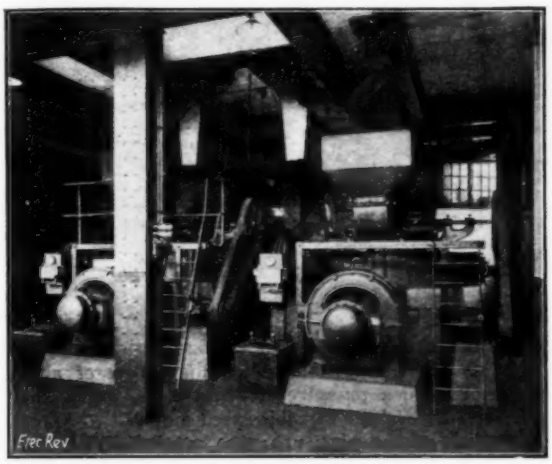


Fig. 4. Raymond Pulverisers.

bearings for the vertical and horizontal shafts, the latter being coupled to an 80-h.p. motor. Air is drawn into the mill through tangential ports in the base, picks up the pulverised coal in passing, and circulates in the separator before entering the suction line of the exhauster fan. In this way larger particles of coal which might find their way into the fan are dropped and undergo further pulverisation. The raw coal is fed into the mill by an automatic feeder, which consists of a pocketed cylindrical roll rotated by a series of ratchets and pawls operated by an adjustable crank; the

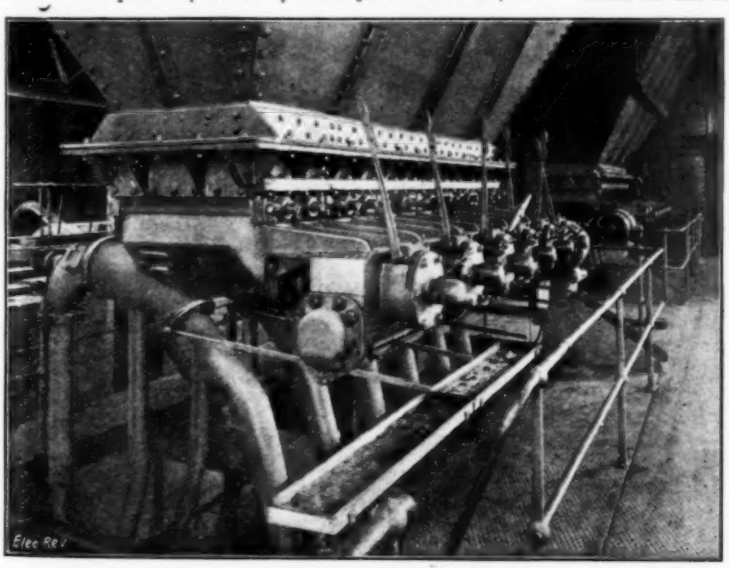


Fig. 6.—Feeder Gallery.

adjustment is such that a very wide range of feed is obtainable. The quantity of circulating air is adjusted so that the coal leaving the mill has a fineness corresponding to 85 per cent. through a 100-mesh sieve and 100 per cent. through a 40-mesh sieve.

Each mill is fitted with an exhauster fan with air ducts, by means of which the coal dust is conveyed to the cyclone separators, fig. 5, situated at the top of the boiler house. In the cyclone the fuel is separated from the air by centrifugal action and gravity, falling to the bottom, whence it is discharged through flap valves into a screw conveyor. The various units of each set are all connected by pipes to form a completely closed circuit through which air is continuously circulated by the exhauster fan. The screw conveyor carries the pulverised coal to two 35-ton bins, fig. 9, one over each boiler, attached to the bottom of which are separate feeders,

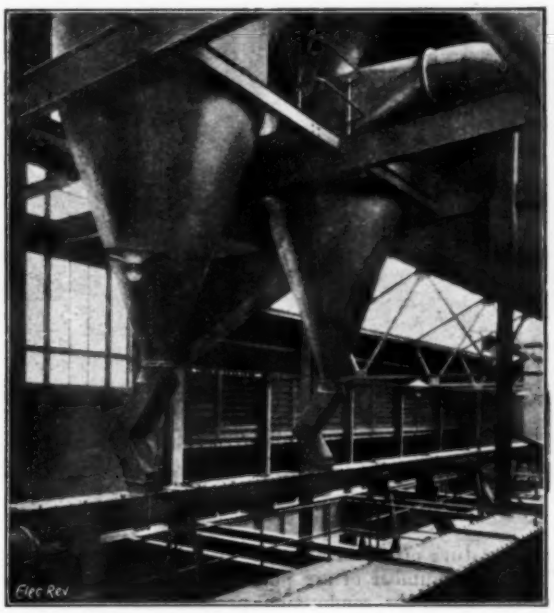


Fig. 5.—Cyclone Collectors and Screw Conveyor.

fig. 6, for each burner, fig. 8, consisting of a cast-iron screw of varying pitch rotating in a trough into which the pulverised coal flows by gravity. The coal is propelled forward by the rotation of the screw into the shrouded portion of the feeder, at the outlet of which it meets the primary air introduced under pressure through a separate connecting pipe. The function of the primary air, which constitutes approximately 15 per cent. of the total combustion air, is to convey the fuel to the burner and to ensure a uniform and uninterrupted flow. The primary air and the pulverised fuel are intimately mixed at the outlet from the feeder by a rotating paddle.

The six burners to each combustion chamber and the six corresponding feeders are arranged in one group, driven by a 9-h.p. variable-speed motor, which enables the feeders to be run at between 35 and 140 r.p.m.; each feeder screw is operated through a clutch and worm gear running in oil, and isolating valves enable individual feeders to be put out of action. One primary air fan is provided for each group of six feeders, of an output of 5,000 cu. ft. p.m. at 16 in. w.g. pressure, and is driven by a 25-h.p. motor. The fans are located on the main floor of the boiler house, and air is drawn through a tubular preheater located in the brickwork of the combustion-chamber floor.

The "Lopulco" burner is a flat convergent fuel nozzle surrounded by air passages through which extra air is induced under the control of a pair of dampers; the outer casing is designed so that the burner may take the place of a standard arch brick.

The combustion chambers are provided with the usual water screen and water-cooled rear wall; each has a volume of 6,507 cu. ft. above the screen. The secondary air passes into the hollow side walls, and thereafter

enters the combustion chamber through ports distributed throughout the length and breadth of the inner front wall; thus the air is advantageously preheated and the

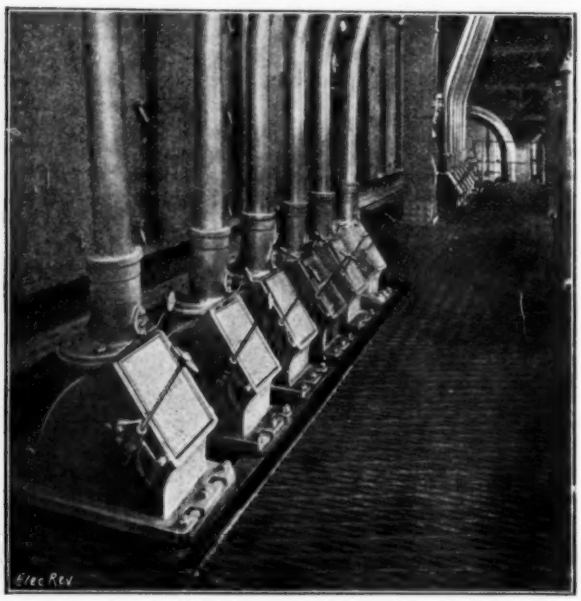


Fig. 7.—Burner Gallery.

temperature of the brick work is considerably reduced. The large number of air ports and the adjustable inlet doors enable the combustion process to be kept under control. The furnace arch is of the "Liptak" double-suspension type. The main function of the water screen, consisting of twelve 4-in. tubes, is to create a cool zone at the bottom of the combustion chamber through which the molten ash passes and solidifies into a finely-divided state before reaching the ash hopper. The rear wall elements consist of twelve 4-in. tubes on the inside surface of the wall to protect the brick work, forming with the screen a useful addition to the boiler heating surface and increasing the evaporative capacity of the plant.

The boilers, fig. 9, are of the Babcock & Wilcox marine cross-type, each of 8,851 sq. ft. heating surface, working at a pressure of 300 lb. per sq. in., and evaporating 60,000 lb. of water per hour at normal load, and 80,000 lb. per hour at overload. The instrument panel is shown in fig. 10. The superheaters are of the B. & W. interdeck type, each of 2,690 sq. ft. heating surface, capable of superheating the steam to a temperature of from 700 deg. to 750 deg. F. They are placed between the upper and lower bank of tube sections to reduce the amount of boiler tube surface in contact with the gases before they pass the superheater tubes, thus providing a higher gas temperature in the superheater zone.

The ash-handling plant was supplied by the British Vacuum Cleaner and Engineering Co., Ltd. The ash is raked out through doors at the bottom of the rear furnace wall into a covered pit on the boiler-house floor, whence it is transported by vacuum.

Each boiler is fitted with a Foster economiser by the Power Specialty Co., Ltd., having 5,616 sq. ft. of heating surface, consisting of elements 16 rows high, each row being 10 tubes wide. The economisers are located on the main-floor level of the boiler house behind the combustion chamber, and are capable of reducing the temperature of the gases from an initial 610 deg. F. to a final 350 deg. F. at normal load.

The Oswald Stott induced-draught fans, one per boiler, are located on the same floor level as the econo-

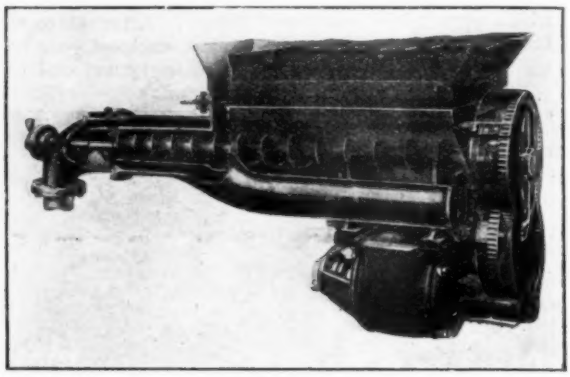


Fig. 8.—Burner Feeder.

misers, and each is capable of dealing with 54,000 cu. ft. of flue gas per minute at a temperature of about 400 deg. F. and a pressure of about 4 in. w.g. They are driven by 85-h.p. variable-speed motors.

The whole of the pipework was erected by Messrs. Aiton & Co., Ltd. The pipework is of interest in that two boiler installations providing steam at different pressures and temperatures have not only to supply steam to the generators associated with them, but are

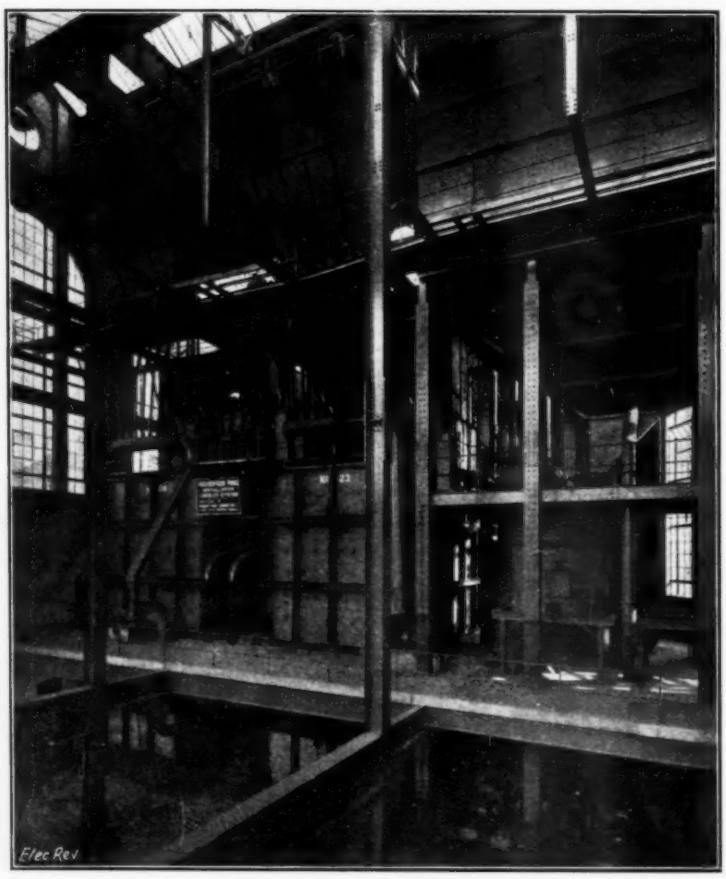


Fig. 9.—Part of New Boiler House.

also interconnected so that the new boilers may supply steam to the old low-pressure mains. The feed system is entirely closed so that only gas-free hot water is supplied to the new boilers, but when they are delivering

steam to the old mains the feed water comes from the old system, which is not gas free. To overcome this, the whole of the feed water is passed through an Aiton degasser which delivers it to the sealed hotwell in the new boiler house. The Aiton desuperheating apparatus of the "Arca" type combines the complete reducing valve

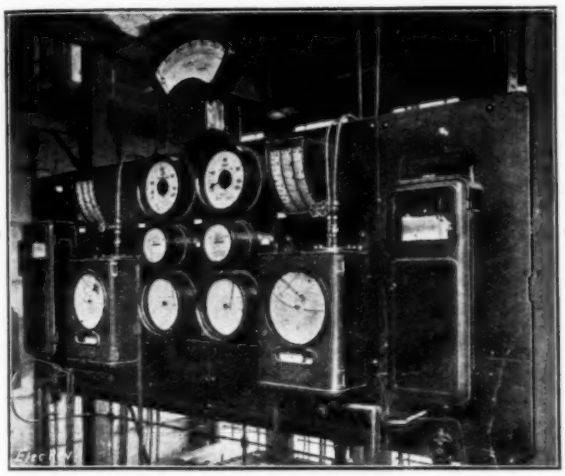


Fig. 10.—Boiler Instrument Panel.

and desuperheater, and is capable of dealing with the whole of the steam required for the old plant, which is working at 180 lb. per sq. in. and 550 deg. F. The make-up feed water required is obtained from a double-effect distiller by P. & B. Evaporators, Ltd., which produces 10,330 lb. of distilled water per hour at 212 deg. F.; the distillate is free of oxygen and chemically pure. At maximum output the plant only consumes 1,780 lb. of high-pressure steam per hour, and it is of the non-scaling type. For removing dissolved gases from the feed water an Aiton deaerator is capable of dealing with 140,000 lb. of water per hour. In the upper part of this apparatus about 95 per cent. of the contained dissolved gases is removed by subjecting the water simultaneously to an increase of temperature and a reduction of pressure; in the lower part the residual dissolved gas is removed by passing the water over deactivating material.

Weir steam-driven and Drysdale electically-operated boiler feed-water pumps are used.

Industrial Combustion Engineers, Ltd., Electroflo Meters Co., Ltd., and James Gordon & Co., Ltd., were responsible for the instrument equipment, whilst the telephones were supplied by A. Graham & Co., Ltd.

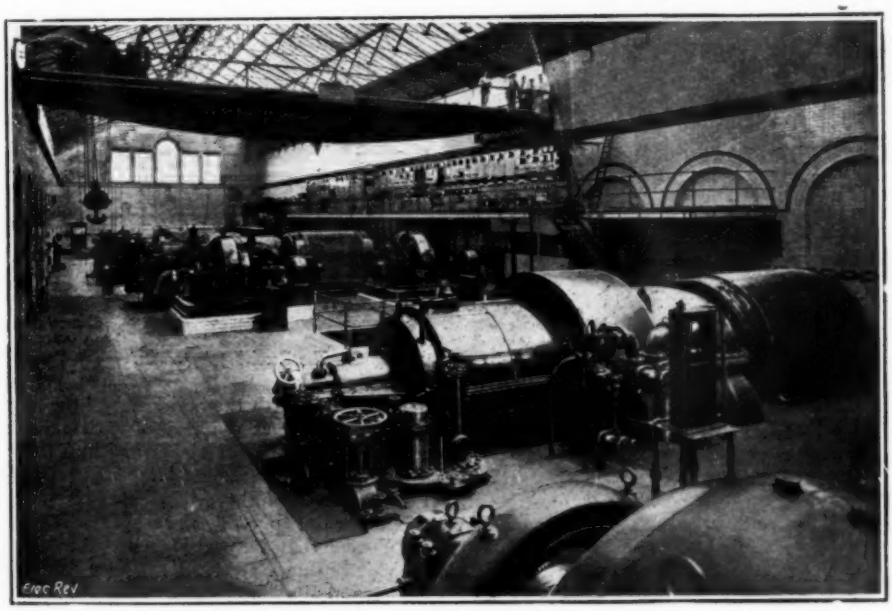


Fig. 11.—General View of Turbine Room.

The turbine room is illustrated in fig. 11. The new turbo-generator and condensing plant was constructed by Messrs. C. A. Parsons & Co., Ltd.; designed to give an economical output of 8,000 kW, its maximum continuous output is 10,000 kW at 3,000 r.p.m., a power factor of 0.8, 3-phase, 50 cycles, 6,600 volts. The standard station steam conditions are 290 lb. gauge pressure at the stop valve, 700 deg. F. total temperature (281 deg. F. superheat) and an exhaust vacuum at full load of 29 in. (bar. 30 in.); steam is extracted from the turbine at a pressure of 10¾ lb. per sq. in. absolute to heat the feed water to 180 deg. F. before entering the economisers. The turbine is of the single-cylinder pure reaction type, with "end-tightened" blading. For the alternator ventilation, a closed circuit with surface air coolers is employed. The surface condenser's external cooling surface is 12,500 sq. ft.; the quantity of cooling water circulated per minute is 9,500 gallons.

Additional 6,600-volt switchgear has been provided in an annexe to the main station, of the cellular type manufactured by the British Thomson-Houston Co., Ltd., phase barriers and duplicate busbars being provided. The oil circuit-breakers are solenoid operated, the control board being in the main station and forming an extension of the existing gear, which was also manufactured by the B.T.-H. Co. Current transformers and a protective relay ensure that the old and new banks interconnector circuit-breakers deal with fault currents which are too heavy to be broken satisfactorily by the smaller circuit-breakers on the existing equipment and the four new feeders.

Connected solidly to the 12,500-kVA generator is a transformer for supplying the station auxiliaries at 400 volts; for starting, and in case of emergency, an alternative supply is taken from the station transformer.

During the year 1925-26 the total energy sold by the undertaking amounted to 29,030,976 kWh, and the fuel consumption was 2.18 lb. per kWh generated. The station now houses seven Parsons steam turbo-generators of an aggregate capacity of 28,250 kW. The development of the undertaking has been due to the energy of Mr. T. P. Wilmshurst, M.B.E., M.I.E.E., who became borough electrical engineer in 1898. On his recent appointment to the Electricity Commission he was succeeded by his deputy, Mr. G. H. Lake, A.M.I.E.E. An account of the official inaugural ceremony of the new portion of the works will be found elsewhere in this issue.

It is of interest to recall that the Derby undertaking holds one of the first places in the country with regard to low coal costs, so that the introduction of pulverised fuel should enable the electricity works to create still further records in this direction. Last year the Corporation sold over 171 kWh per head of the population, whilst the average price obtained over the whole output was only 1.57d., yet a profit of £26,774 was made, which goes to prove the soundness of the policy of cheaper electricity which Mr. Wilmshurst and the Corporation Electricity Committee have so consistently advocated.

This is the first municipal power station to commence the operation of a boiler-house designed initially for burning pulverised coal on a fairly large scale—another milestone of progress.

Television.

Some Particulars of the Baird Apparatus.

By A. DINSDALE, A.M.I.R.E.

In the present age scientific research progresses with such stealthy speed that only those who are in direct touch with a particular branch can hope to keep abreast of the times.

The progress made in "Television" is an outstanding instance; barely three years ago the crude shadows transmitted by Rignoux and Fournier in 1906 were the nearest pretensions to television. Then some three years ago shadows were again transmitted by Baird in England and Jenkins in America. These demonstrations, however, which consisted in placing a simple object between an immensely powerful beam of light and a photo-electric cell and sending a crude *shadow* of such things as a key ring or a few fingers of the hand, while possessing a certain academic interest appeared to be quite outside the sphere of practical utility.

When, in 1925, Mr. J. L. Baird made the step from transmitted to reflected light and demonstrated that it was possible to send outlines of objects illuminated directly instead of only their shadows, some further interest was aroused, but those who saw the demonstration will remember that only crude outlines in black and white were transmitted, and the result appeared still to be merely of experimental interest.

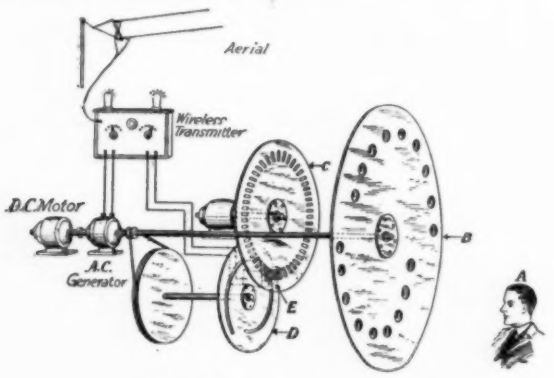


Fig. 1.—Part of the Transmitting Plant.

This year, however, matters assumed a different complexion. True television was demonstrated for the first time, and living human faces were sent, not as outlines or mere black-and-white effects, but with detail and light gradations—a truly marvellous feat when we consider the immense difficulty of the problem.

Very little in the nature of technical detail has been hitherto available, but owing to the courtesy of Mr. Baird I am able to give some diagrams which have not previously been published. These diagrams illustrate the mode of operation of the model with which outline images were first sent by reflected light, and it is upon the system indicated by them that subsequent machines have been developed.

The object A to be transmitted, fig. 1, was placed in the light of a powerful tungsten-filament lamp. In the early experiments very powerful lamps (2,000 c.p.) were used, but it has now been found possible to reduce the total illumination to less than 300 c.p., using a number of ordinary 20-watt lamps.

The lens disk B revolved at about 800 r.p.m., and threw a succession of images of the object A across the aperture E, leading to the light-sensitive cell (shown dotted). Owing to the staggered arrangement of the lenses, each lens caused a different strip of the image to pass across the aperture.

In the machine illustrated, 16 lenses are shown, and as the lenses are arranged in two sets of eight, only eight strips would be given. To impart a finer grain to the image, a rotating spiral slot passes in front of the slot, admitting light to the cell; this slotted disk D rotates once for every four revolutions of the lens disk, so that four times the number of strips are obtained. The disk E revolves at 4,000 r.p.m., and interrupts the light rays at a high frequency.

The combined action of these revolving disks is to cause an image of the object being transmitted to fall in a succession of little squares on the light-sensitive cell and thus cause a fluctuating current, the intensity of which is dependent on the intensity of illumination of whatever section of the image is traversing the cell.

This fluctuating current is then transmitted to the receiving station, fig. 2, by wireless or by wire, where, after amplification, it controls the light of the glow discharge lamp K (dotted outline).

This lamp has a slot in front of it, and in front of the slot revolves the spiral; in front of this again is the lens disk, which projects on the screen an image of the aperture formed by the conjunction of the spiral and the slot. This optical device revolves in synchronism with the optical device at the transmitter, and thus a spot of light traverses the screen at the receiver in exact step with the traversal of the image over the cell aperture at the transmitter. The spot of light varies in brilliance in exact accordance with the brilliance of the transmitted image, and traverses the screen with sufficient rapidity to enable persistence of vision to cause the eye to see the whole image instantaneously.

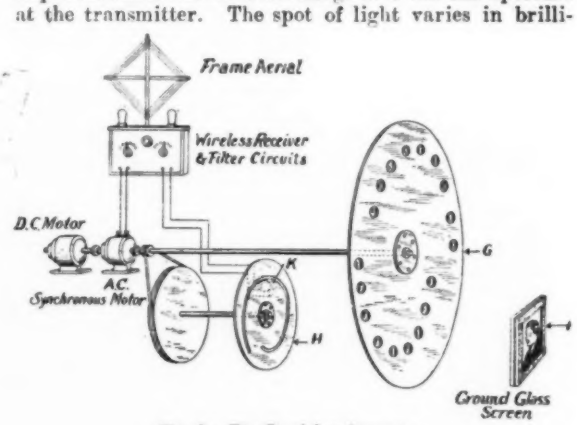


Fig. 2.—The Receiving Apparatus.

Details of Mr. Baird's light cell are not at present available owing to the patent situation. It is, of course, to this device that the successful demonstration of television is chiefly due, and details will be published as soon as they are available.

At the present time, from 2TV in Upper St. Martin's Lane, Mr. Baird is nightly transmitting to a receiving station at Harrow. Transmission takes place on a wave-length of 200 metres, and the transmission may be heard on an ordinary wireless receiver as a peculiar rhythmic humming sound of continually changing pitch.

2TV is the first television station in the world, and we may congratulate ourselves that Great Britain occupies the leading position in this new branch of electrical engineering.

New Swedish Ignition Plug.—A Stockholm engineer, M. K. J. Isaksson, has invented a new self-cleaning ignition plug for motors called "Viking-Ite." The invention is to be exploited by Aktiebolaget Lidkoepings Vikingsaagar, a company affiliated to the Sandviken steel works. The price of the new plug is somewhat higher than that of other plugs, but it is thought that a large market will be found for it.—*Reuter's Trade Service* (Stockholm).

Imperial Wireless "Beam" Communication.

The Inauguration of the England-Canada Public Telegraph Service.

(*Concluded from page* 712.)

The angle of the beam is of the order of 10 deg. as is indicated by fig. 6, and the energy outside the beam is not more than five per cent. of the energy of the station; 20 kW is delivered to the anodes of the valves used for generating the oscillations. It is claimed that a "beam" station, compared with a long-wave station, has the following advantages: the capital expenditure involved is considerably less, it is more economical to run and maintain, and it is by far the most speedy method of point-to-point communication yet devised. Its speed of working is at present limited only by the mechanical limitations of the transmitting and recording instruments, and when suitable means of recording over landlines at higher speeds than those at present obtainable have been developed it will be possible to increase correspondingly the overall speed of signalling.

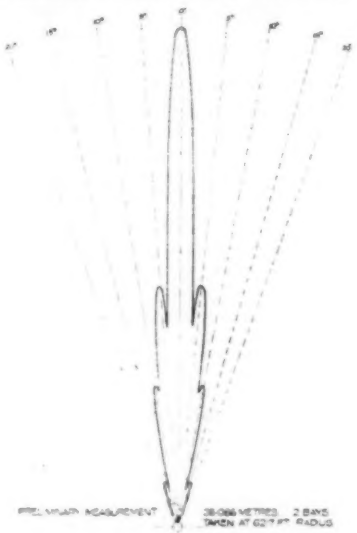


Fig. 6.—Polar Curve, Bodmin Station.

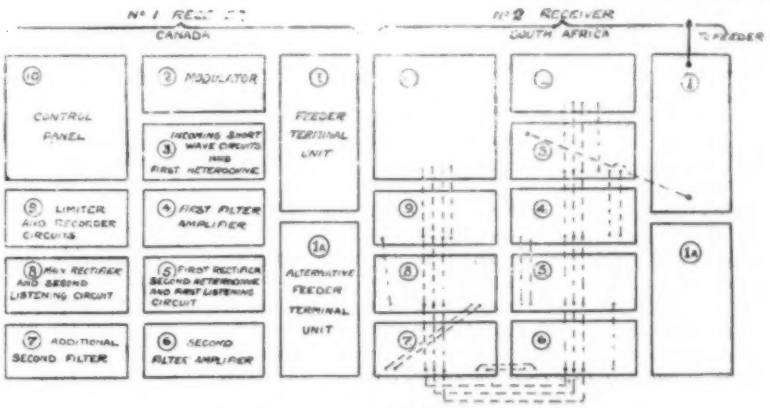


Fig. 7.—Lay-out of Receiving Apparatus.

Call Letters and Wave-lengths. — The Bodmi. plant operates on 26.09 metres (11,500 kilocycles) and the Canadian at 26.27 m. The call letters for the England-Canada service are "GBK." The change-over from one wave-length to another can be accomplished in from seven to ten minutes, the procedure being as follows:—Drive panels B and C are distinct for the two wave-lengths; one of them is shut down and the other energised; the wave-length of No. 1 magnifier is altered by changing one commutator board for another, which has links previously adjusted for the wave-band required (actually this varies the inductance in the main closed h.f. circuit). No. 1 magnifier is then rebalanced, and the feeder link is thrown over to the required set of aerials; the load-coupling circuit having been previously set, only a change of one link is required, and the set is then ready to transmit on the new wave-length.

Aerials.—The aerial construction has a definite relation to the wave length used. At Bodmin the one now in operation functions at 11,500 kilocycles, and occupies two bays; there are 32 aerial wires in all, 16 in each bay, and 64 reflecting wires. Each short-wave aerial wire consists of three sections linked by inductances, or phasing coils, the whole attached top and bottom by means of insulators fitted with corona rings. The short-wave reflector wire consists of five lengths separated by insulators between each section. The wire used is either No. 10 copper or No. 16 copper-clad steel wire.

Earthing.—The short-wave reflector earthing arrangements are essentially different from those associated with long-wave stations. Each aerial-coupling box is earthed by means of 12 plates, arranged in a circle round the box. There is absolute continuity throughout the whole of the outer tube of the feeder system, and it is earthed throughout. Each transmitter has an independent earth, and both masts and stays are earthed.

Messrs. Henley's Telegraph Co. and Fuller's Electric Co. have supplied cables and wiring; Messrs. Stanley Cooper & Co., Bournemouth, installed the electric light, and Messrs. E. N. Bray, Ltd., supplied motor-starting pillars.

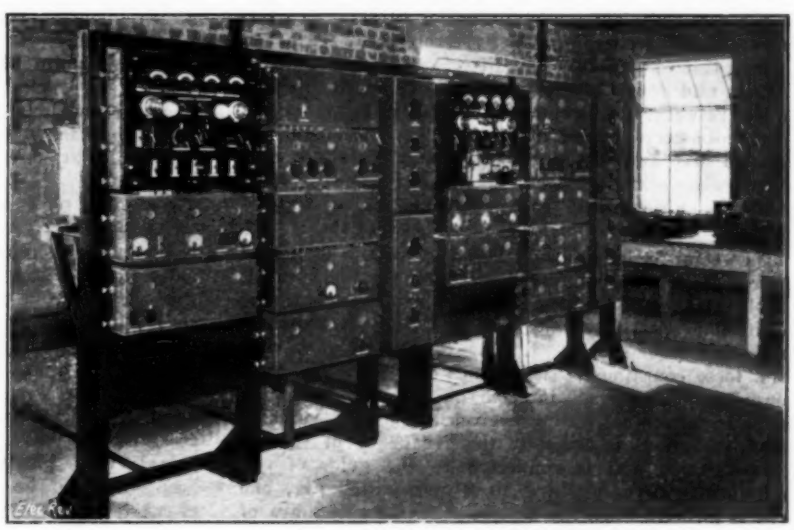


Fig. 8.—Short-wave "Beam" Receiving Plant at Bridgwater.

The Bridgwater Station.

The Bridgwater beam receiving station is about 60 ft. above sea level, with open country around it in all directions, so it is not screened.

The buildings are of brick, and the continuity between

the engine and the receiver rooms is definitely broken, to avoid the transmission of vibration. The building work was carried out by the Foundation Co., Ltd., and electric lighting was installed by Messrs. Stanley Cooper and Co., Bournemouth. Power is generated by two 18-h.p. Aster petrol-paraffin engines, directly coupled to two Metropolitan-Vickers 10-kW dynamos supplying 110 volts to the main switchboard, for charging the 132-Ah battery used for lighting the station, and for driving four Crypto motor-generators for charging the two 760-Ah filament and two 30-Ah anode batteries; the plant is in duplicate throughout. The switchboards were manufactured by Harland Engineering Co., Ltd., and the batteries by the Tudor Accumulator Co.

The receivers, figs. 7 and 8, stand near the wall where the feeders enter the building, and at right angles to them is a table for the recording apparatus and land-line instruments. The received signals are put direct to line, through "A.T.M." high-speed relays and, when required, can be checked for formation by means of undulators. A Wheatstone transmitter is also installed for testing purposes. A Post Office omnibus sounder circuit connects the Central Radio Office, in London, with the Bridgwater and Bodmin stations for control purposes, and there are, in addition, two direct telegraph lines to London for the transmission of received signals.

The Receivers.—The Bridgwater receiver's wave-length can be altered by using the other aerial bay. The call letters of the Canadian transmitting station are "COG."

The masts (which were manufactured by the Armstrong Construction Co. and erected by Messrs. Francis Morton & Co., Ltd.), aerial and feeder system (the copper tubes of which were manufactured by the Yorkshire Copper Co., Leeds) are duplicates of those at Bodmin. The masts are at right angles to the direction from which the signals are received, and the effect of the reflector wires is not only to screen the aerial from signals coming from behind, but also to reflect back to the aerial energy received from the front of the system. Providing that the incoming signal from the front of the system is of the wavelength for which the aerials and reflectors are tuned and spaced, the energy received upon the latter is reflected back on to the aerial exactly in phase with that directly induced, which affords a very considerable increase in the energy received, as compared with a broadcast, or non-directional, aerial. By means of transformers and the special feeder system the energy of all the aerial wires is added and the total energy conveyed to the receivers, *via* the main feeder tubes, which terminate at a "feeder unit" of the receiver.

Reception is from two directions, namely, from Canada and South Africa, and in order to avoid inter-action between the circuits, as they are worked on a common-battery system, the frequency of the bands of the two first and two second filter amplifiers are suitably spaced; otherwise the receivers are identical. Each comprises nine units, each contained in a copper-screened box to prevent inter-action between them.

The aerial feeder terminal unit has two low-loss tuned intermediate circuits, with provision for very weak coupling between them to afford a means of obtaining additional selectivity and freedom from atmospheric and other interference. It is customary to work with very loose coupling as the signals are generally very powerful. The second intermediate circuit is coupled to the input circuit of the receiver (through a variable coupling) which is tuned to the frequency of the incoming wave, and is connected to the grids of two modulating valves working in "push-pull," *i.e.*, one grid is positive when the other is negative; they are of the LS5D type, the grids of which are taken in through the glass instead of the plug socket at the bottom, in order to keep down capacity effects. The input and filtering-amplifier valves all work on the push-pull principle, which gives stable and distortionless high-frequency amplification. Coupled to this circuit is the first heterodyne circuit, using one DE5 valve, which produces (with the incoming signal) a beat wave of about 1,600 metres. The signal on this new wave is subjected to three stages of high-frequency push-pull amplification, each stage being dealt with by two DE5B valves working in push-pull, and these circuits have been so constructed that constant amplification is obtained over a 10,000-cycle band, *i.e.*, 5,000 cycles on each side of the middle point; outside this band amplification is practically zero. The frequency of the first heterodyne is adjusted so that the beat which results, with the frequency of the incoming signal, corresponds to the middle frequency of the first band filter amplification. Consequently, if the frequency of the incoming wave varies within the limits of the band, there will be no corresponding variation of energy at the output of the amplifier.

After the three stages of h.f. amplification the signals are rectified and again heterodyned; this second heterodyne can be used, either for giving an audible beat frequency, or for changing the wave-length of the signals up to about 10,000 metres. This change is effected by means of a switch which, when placed in the "audio," or closed, position enables the operator to listen to the incoming signals and to tune the initial circuits of the receiver. A milliammeter in series with a telephone transformer in the anode supply to the rectifier valves, which terminate at the first three stages of amplification, is used as a check on the action of the second heterodyne, to measure the strength of the incoming signal, and to assist in adjusting the first heterodyne to the middle point of the band provided by the first amplifier.

On opening the heterodyne switch already mentioned, the beat frequency of the signal is raised to about 30,000 cycles (about 10,000 metre wave-length) at which frequency it is subjected to three more stages of high-frequency amplification. This second filter amplifier is similar to the first, except that the band is only 5,000 cycles wide; normally, three stages of amplification are used for the second filter amplifier, but two additional stages may be added if necessary.

After the second amplifier the signals are again rectified by two LS5B valves which are fed by a separate dry-cell h.p. battery of 160 volts. The valves are set to the zero rectifying point by suitably biasing their grids with negative potential obtained from a dry-cell battery and a potentiometer shunted across the 6-volt l.p. supply for final adjustment. A switching key is provided by means of which the equivalent of a signal is obtained; the switch disconnects the battery supplying the grid biasing voltage, and connects the grids directly to the negative side of the filament, in this way providing for testing the limiter and recorder circuits.

The outputs of the rectifier valves are put in parallel into the limiting valve of the recording circuit through a milliammeter, which indicates the signal strength and assists the attendant in adjusting the second heterodyne to the mid point of the second filter-amplifier band. A part of the dry-cell anode battery feeding the rectifier valves is used to provide positive potential to the grid of the limiting valve, which is adjusted to give about three to four milliampere of plate current when the current in the plate circuit of the rectifier valve is zero. The effect of the incoming signals is to balance this positive potential. The minimum recording signal strength is that which reduces the plate current of the limiting valve to zero; any signals of a greater intensity than this are mostly dissipated in a resistance, so that the energy supplied to the d.c. "bridge" is constant.

The "bridge" provides both marking and spacing current for operating a high-speed "A.T.M." relay which, in its turn, keys the Post Office land-line to London, and, when required, a check undulator at the receiving station. To provide a means of checking the signals when passing to line the following device has been adopted: The audible-frequency oscillation of 1,200 cycles from a valve generator is superimposed on the first heterodyne, so that when the incoming signal is heterodyned the resulting frequency passed through the first band-filter amplifier has an audible note superimposed on it, and at the end of the circuit (after final rectification) a single valve circuit tuned to this note frequency is coupled to the main circuit. By this means it is possible to listen to the signal, which gives a perfectly steady note of constant strength, at two points without the necessity of using an oscillator at either point to give an audible beat frequency, even if the

frequency of the incoming signals is varying, provided the variation does not cause the first beat frequency to alter so much that it occurs outside the band limits of the first filter amplifier.

The receiving and recording apparatus was manufactured at the Chelmsford works of Marconi's Co., and the valves were manufactured at the works of the M.O. Valve Co., at Hammersmith. The cables were manufactured by Fuller's Electric Co., and the motor starting pillars by Messrs. Veritys.

Earthing.—The earthing arrangements consist of a ring of plates spread round the end of the receiver building.

Other Stations.

The South African stations are practically complete. Similar stations are being built at Tetney (near Grimsby), and at Winthorpe (near Skegness) for communication with Australia and India, with corresponding stations in the Dominions near Cape Town, Melbourne, and Bombay, and they are expected to be opened within the next few months which will complete the present Imperial scheme; but outside this scheme the Marconi Co. holds a licence from the Post Office to conduct wireless-telegraph services with certain Continental countries and with all other foreign countries outside Europe. In addition to the long-wave stations which it has been operating for some years, it has a "beam" station nearly completed at Dorchester, for communication with North and South America; a corresponding station is also in process of erection at Rio de Janeiro. Another important development is the scheme for linking Portugal and her colonies. The stations are now being built at Lisbon, in the Cape Verde Islands, the Azores, and in East and West Africa. When they are completed services will be established with England, the principal Continental countries, and with South America. The short-wave beam stations for this scheme are being erected at Lisbon, Loanda, and Mozambique.

Selling Electricity.—III.

Some Impressions of American Methods.

By R. HARDIE,
Glasgow Corporation Electricity Department.

Payment of Electricity Bills.

Minimum bills are universal. There is a wide variety in collection methods, but the convenience of the public is always the main consideration—in many cities electricity bills may be paid at authorised banks and drug stores. Some companies grant discounts for prompt payment (within ten days of issue) as high as ten per cent., while others charge additional sums for accounts not paid within a fixed period.

Advertising.

Everywhere one found supply companies devoting large sums of money to systematic newspaper advertising. These were not 6-inch single-column insertions, but often half-page and full-page advertisements, usually announcing some special concrete feature, *e.g.*, the offer of a vacuum cleaner, refrigerator, clothes washer, cooker, or iron on special terms for a limited period. As the average evening newspaper consists of 40 to 50 pages, an advertisement has to be large and bold to be effective. The actual outlay in this direction of a few companies taken at random was:—

(A) £4,500 per annum.
(B) £70,000 to £80,000 per annum.
(C) £30,000 per annum.
(D) £2,500 per annum.

In one case I was informed that only 4 per cent. of the advertising cost was charged against the merchandising department, because for "goodwill" and "policy" reasons they advertised in all local papers, irrespective of value or results obtained. Manufacturers also do their share. One firm spends 5 per cent. of income in advertising. It has ten to fifteen full-page (in colour) advertisements per annum, each costing £1,900, in one of the national weeklies having a circulation of several millions. In another factory one found a complete printing plant occupying a large floor, where all the firm's requirements for catalogues, posters, circulars, and dealers' helps of every description were produced by its own staff.

Samples of Typical Advertisements.

This advertising copy may not appeal to ultra-dignified and mild-mannered advertising men, but it does produce the business, and it is claimed, rightly I think, that advertising copy that achieves the results already quoted:

2,000 Vacuum Cleaners
and
800 Washing Machines
in 30 days

has made the right appeal, and should not be weakened by the addition of artistic lettering or prettily phrased generalities.

Electric Vehicles.

As in Britain, the development of this business has been tardy. New York, I understand, has now 4,000 vehicles in the streets, while Chicago has some 2,300 street trucks and over 600 industrial trucks—the Commonwealth Edison Company itself operates 290 electric vehicles; but when you know that one firm alone in the United States manufactures 6,000 automobiles (petrol) per working day all the year round, the comparative insignificance of any progress made to date in the electric-vehicle field does not require emphasis. Several of the larger power companies are now devoting special attention to this business, and the Society of Electrical Development is also concentrating on it. In spite of this, one has to deplore the fact that the *low speed* of the electric passenger car is made the subject of ridicule in a popular "Paramount" picture now showing in the United States. That it is business well worth striving for is evidenced by the fact that even with to-day's limited development one central station derives a revenue of over £120,000 per annum from the sale of energy for battery charging.

Railways—Electric and Others.

It is gratifying to be able to state that America has little to teach us regarding railway transport. Electric overhead railways in two cities visited did not impress one: they seemed altogether unworthy of their surroundings. The Underground Railway in New York, also, is far removed from what one would expect in a city outstanding in so many other details, and might profitably be refurnished on the lines of the London Tube system. Even crack main-line trains ("20th Century," "National Limited," and others), although comfortable and possessing many novel features, for speed at any rate, are inferior to much of our rolling stock. Steam locomotives are still the rule and not the exception.

Company Management.

As has been indicated, electricity supply is almost entirely in the hands of private companies, but the interests of consumers are safeguarded, as I have already shown. Their chief dread is further interference by State or Federal Government, and one admits frankly that they are at present doing their work well, with a minimum of supervision from either source. But even New York, with its enormous connected load and output, has by no means reached its limit. The companies have not yet taken over all private plants. It is pos-

sible to-day to find in the heart of Broadway a block of offices, erected as recently as 1915, with a maximum demand of 1,900 kilowatts, having its own generating plant, consisting of:—

Three 600-kW generators
Two 300-kW generators
One 200-kW generator
Total 2,600 kilowatts.

This block, with its 39 floors and 2,500 large offices, has an estimated annual consumption of between five and six million kilowatt-hours. There are fifty express elevators in this block, two restaurants, club, banks, safe deposit vaults, &c.

Height of building, 545 ft.
Area of building, 50,000 sq. ft.
Rentable area, 1,200,000 sq. ft.

Without doubt, this is the largest office building in the world—and one fine morning presumably this desirable load will be handed over to the central station. I visited another block in Detroit, with 1,700 offices, and an annual consumption of between four and five million kilowatt-hours. This is of more recent date, and is supplied from the company's mains.

General.

In every factory visited were found busy operatives in receipt of high wages, putting forward every endeavour to obtain high production, and apparently on the best of terms with the management. Everywhere one saw huge factories, and these being added to in an endeavour to keep pace with growing demands. In conversation with many executives, it was apparent that the workman was considered worthy of his hire, and the high wages were paid without grudge, no matter how princely these might appear to one coming from a country where fifteen dollars per week is considered ample remuneration, even for a skilled artisan. On the selling side I spoke with outside "solicitors" selling electric vacuum cleaners, who were earning as much as 4,000 to 5,000 dollars per annum—a select few exceed this—commission on sales actually concluded. True, these figures refer to exceptionally good men, enthusiasts who revelled in their work and lived early and late on their job. Employers recognise that the higher the earnings of these men, the larger the profits to the firm—a point of view almost original to one accustomed to old-world practice. Payment by results, alike to the workman manufacturing the product and to the representative selling the product to the consumer, appealed to me as a satisfactory method of doing business, vastly superior to the fixed wage and salary methods generally obtaining in Britain. The working conditions in the factories visited were superior to those in our country, every effort being made to create a healthy and cheerful environment. The tendency of many large companies to grant facilities to employés of every grade to own the companies' stock, yielding a fixed high rate of interest, has much to commend it; likewise the practice of money advances enabling employés to purchase their houses, while possibly not altogether unselfish, may be worthy of emulation.

Americans have acquired a reputation for hospitality, and my experience confirmed this. One met with nothing but kindness from all business friends, everything possible being done to render one's visit interesting and educative. At no time was this more apparent than when the secretary of the National Electric Light Association arranged for my taking part in their annual Convention held in Atlantic City in May. The opportunity of inspecting the most comprehensive display of electrical merchandise ever assembled under one roof, of meeting with many of the leaders of the industry, the privilege of listening to the speeches of President Davidson and others, were evidence, if such were required, of their good feeling, and the more so as I was the representative of a municipality, and the name "Municipality" is anathema to the National Electric Light Association.

Electrical Contracts in Brazil.

Central Railway Electrification Delays.

By PERCY F. MARTIN, F.R.G.S.

When, exactly four years ago, Dr. Arthur da Silva Bernardes assumed the Presidency of Brazil, he promised, among many other urgent reforms, greater development of the country's hydro-electric services, particularly with regard to railway transport. If, at the approaching end of his term, it cannot be said of Dr. Bernardes—as was said of Joan of Arc

"Thy promises are like Adonis' gardens,
"That one day bloom'd, and fruitful were the next,"

it may at least be urged that he has done what lay within his restricted powers, and he will leave his high office with the knowledge that no constitutional ruler could have done more.

If the amount of actual progress in hydro-electric exploitation in Brazil has been small, indeed, almost insignificant considering the immense opportunities that nature has generously offered in the way of magnificent waterfalls located near the coast and innumerable streams suitable for the generation of electricity, the fault must be attributed to a political system which enables party prejudices and vested interests to interfere with and sometimes to destroy legitimate commercial development. No other country in either the old world or the new could have done so much and yet have accomplished so little as Brazil. Moreover, the oft-proffered assistance of foreigners has been regarded, except in some few cases, with suspicion, co-operation being rendered so difficult that all attempts to proceed have been rendered impossible. This, then, is the cause of Brazil's failure to keep abreast of other South American countries, such as Argentina and Chile, which, without their neighbour's abundant material resources or consuming population, have succeeded in effecting great advances in electrical undertakings.

While practically every town in Brazil has its street railway, barely 10 per cent. are run electrically. The archaic mule-drawn car is still found, sometimes even running side by side with an electrically-propelled vehicle.

This month (November) will witness the completion of the seventh year since the Brazilian Government announced its intention to proceed with the electrification of the Central Railway. As a result of the widely-advertised invitations to tender for the work, an Anglo-Italian syndicate offered—as far back as 1919—to undertake it; while a French syndicate, in the following year, submitted a competitive proposition of a similar character. Neither contract was accepted, for the reason that the Government had not quite made up its mind how to obtain the funds necessary to carry out the project. Two years passed before anything further occurred. Then a Commission of Finance of the Federal Congress of Brazil was appointed. This body, composed of engineers and officials, after several solemn meetings, made an announcement to the effect that: "The Executive Committee has been authorised to open a credit of 45,000 contos of reis (then worth about £2,900,000) to

cover the cost of changing the Central Railway from steam to electricity on the following suburban lines:—Deodóro; Barra-do-Pirahy; Santa Cruz; Paracamby and Maritima." Subsequently, the Senate Finance Committee increased this credit of 45,000 contos to 60,000 contos. Through the offices of the Department of Overseas Trade, acting upon the suggestion of H.M. Commercial Secretary in Rio de Janeiro, United Kingdom firms of contractors were invited to send in tenders which would be accepted, so it was said, by the Inspectoria Federal das Estradas Ministeriál da Viçao y Obras Públicas, at Rio de Janeiro. In the preliminary particulars supplied officially, the length of line to be electrified was mentioned as averaging 109 km.

During the whole of 1921 no more definite steps were taken; but in the second month of 1922 the Government again announced that tenders for the Central's electrification would be received in London up to March 15th of that year. The importance of the work, it was pointed out, would attract world-wide interest in electrical engineering circles, since it involved the electrification of 53 miles of that section of the Central Railway carrying the most traffic, as well as the construction and installation of the signal systems for four substations, the furnishing of 22 electric locomotives and of 150 electric motor carriages. A period of two months was allotted for the sending-in of tenders, and, at the end of April, bids which had been received from many different contractors in the United States and on the Continent of Europe, were opened in the presence of the interested parties. The offers included schemes and carefully-prepared estimates submitted by the General Electric Co. and the Westinghouse Electric Co. (American), and the Metropolitan-Vickers Electrical Co. (British). The Government found, however, that the proposals contained "so many alternative specifications that it was impossible to state which was the lowest." A further examination, however, led to the conclusion that the lowest tenders received were those of the Metropolitan-Vickers and the General Electric Co.; but, before either was accepted, the administration occasioned further delay by nominating experts to study the proposals anew. The total value of the contract was £2,000,000, and it is not without interest to recall that representatives of several American banking houses took part in the negotiations with the Government for financing the work. No such offer was made by the British tenderers.

In the month of September following, the Minister of Transport notified that the best terms offered, both with regard to price and technical advantages, had been those of the General Electric Co., of the United States, and that to that company, therefore, the contract had been awarded. This brought the matter down to the end of 1922, and the next phase was the introduction of a public loan, raised in America, for the purpose of building the Brazilian Central Railway. So well had the issue been advertised in New York, that allotments in that centre of wealth alone had been on the basis of 20 per cent. of the amount applied for. All the more surprising came the subsequent announcement that the carrying-out of the electrification work was still postponed, and something like a shock followed when it was learned that the Administration, of which Dr. Epitacio Pessoa was then the head, had diverted the greater part of the proceeds of the American loan from the construction of the Central Railroad to the entirely different purpose of improving the Federal Railways. Notwithstanding the fact that the loan ($25,000,000) was raised for the specific purpose of electrifying the Central Railway, no work of this character had been done on this system up to the end of 1923.

Nor was anything further heard of the enterprise until May of last year, when the Minister of Public Works asked Congress to grant a credit of 1,500 contos of reis for "urgent repairs" in connection with certain lines of the Central, but said nothing at the time about its electrification. Two months ago, however, the Brazilian Ministry of Transportation announced that the electrification of the Central Railway would positively be started "before the end of the year." Thus a wasted seven years has come and gone since the announcement of this electrical enterprise was first made, while four-and-a-half years have elapsed since the money to carry it into effect was raised and received. How urgently this work is needed to relieve the unfortunate railway position in Brazil may be gleaned from the pages of a recent British Consular Report, which declares that: "the carrying capacity of the Central Railway's trains is daily exceeded by 100 to 150 per cent., a condition of affairs which has caused disasters and deaths owing to the accumulation of people on the platforms of the cars."

Apart from purely Government enterprises, strenuous competition exists between British and American electrical contractors for railway construction, power stations, water installations, &c. Representatives of both nationalities are in Brazil watching for any opportunity that may present itself. At present, however, monetary conditions are so unsatisfactory that there is little encouragement to expend large sums of money upon personal representation, although it is recognised that little can be effected without it. Upon occasions, competition is so keen, and the conditions offered are so equal, that even the responsible authorities themselves are at a loss to know to which particular contractor or contractors the projected work should be allotted. On the one hand there are available the services of the General Electric Co. and the Westinghouse Electric Co., representatives from the United States; on the other are found the English Electric Co., and the Metropolitan-Vickers Co., of Trafford Park.

To America some few years ago went the much-prized contract for the electrification of the first main-line railway in South America, namely, that between Jundiáhy and Campinas, a station on the Paulista Railway, a track having a length of 45 km. (about 28 miles), and the construction of which involved the expenditure of $2,000,000 (£400,000). But it will be remembered also that to the English Electric Co. there had been awarded the contract for the electrification of the Campos-de-Jordao-Pindamonhangaba Railway, a line of 48 km. (30 miles) in length, and upon a portion of which track the gradients range between 6 and 10 per cent. The Metropolitan-Vickers Electrical Co. has since secured the contract for the electrification of the branch line from Barramansa to Pestañha, on the Oëste-de-Minas, a track 73 miles in length.

It is not surprising, perhaps, that British contractors should be discouraged from bidding for Brazilian State undertakings. They are frequently put to a great deal of unnecessary expense and trouble in preparing elaborately drawn-up plans and specifications, only to find that the Government has altered its mind without any preliminary intimation. This occurred towards the end of 1924, when, after fussily inviting foreign contractors to bid for a number of railway projects, a notification was issued to the effect that "owing to the financial condition of the country and the situation of the treasury, all public works which were being executed by the various public ministries would have to be suspended," while, in the case of those which were subject to contracts, "in order to avoid onerous rescissions," agreements proroguing the period for their execution "*must* be entered into." The unenviable position thus created for a number of contractors who had prepared plans, made engagements of staffs and—in some cases—had actually commenced operations, need not be emphasised. With their plant and material upon the ground, and a number of local sub-contracts entered into for labour and material supplies to be carried out or compensation paid, the responsibilities were heavy and could not be shaken off quite so easily as were those of the Government upon whose good faith their co-operation had been offered.

In Brazil there are still certain valuable concessions for electric railway enterprises promising great possibilities, but which are going begging. So far, no successful tender has been received for the projected line to connect Uniao, on the frontier between the States of Paraná and Santa Catharina, with the confluence of the Rio Iguazú and the Rio Paraná. The concession

for this important undertaking has still several years of life to run before expiring by the effluxion of time, and there is every reason to believe that were a sufficiently strong contractor to appear upon the scene a new and wider concession might be granted, or the old one suitably amended and renewed. The line, once built, could be continued from Borga, on the Brazilian frontier, to the port capital of Paraguay-Asunción—thus affording a much-desired outlet to Paraguayan export trade by way of the Brazilian port of Sao Franciscao-do-Sul. The project also embraces the connection of the northern ports of Paraguay with the Brazilian port of Santos by means of an extension to that important centre on the Sorocabana line, from Boituao to Puerto Titirica, on the frontier of the States of Matto Grosso and Sao Paulo.

Attention has been called upon previous occasions to the importance of constructing a new line of electrically-operated railway in the State of Sao Paulo connecting the city of that name with the port of Sao Sebastiao. For this a concession was granted several years ago; it is now held by the Compañhia Paulista, which has made application recently for its extension and amendment. Should the line be built eventually, it would be carried from Sao Sebastiao *via* Sao José-das-Campos to the frontier of the State of Minas Geräs, there connecting up with the Paulista Railway system by another line from Sao José to Sapuahy, which, being within easy distance of Paraisopilis, constitutes a suitable terminus for the line to be built in Minas. In the immediate district there are a large number of waterfalls which could provide ample electrical power for this and other railway operation.

No Brazilian province has done more in the way of electric railway construction than Sao Paulo, which has set an admirable example to the other and less-prosperous States of the Union. Last year not only had Sao Paulo made heroic efforts to bring about the completion of the 48-km. of electrically-operated line between Campos-de-Jordão-Pindamonhangaba, but its administration also finished the 70 km. between Jundiahy and Rebouças (on the Paulista Railway which is the property of the State). It likewise owns the Sorocabana Railway, upon the improvement of which it has been decided to expend approximately 130,000 contos (about £3,250,000).

The type of locomotive used on the Paulista Railway, whose track is 5 ft. 3 in. gauge, is largely, if not exclusively, confined to the American pattern. The passenger locomotives weigh 121 tons, with a horse-power of 2,000 (voltage 3,000), and a speed of 65 m.p.h. maximum. The freight locomotives weigh 87 tons each, with a horse-power of 1,500 at the same voltage, and a maximum speed of 40 m.p.h. The approximate cost of the electric locomotives has been $800,000, against $600,000 per steam locomotive.

Price-Cutting and its Remedies.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

The question of price-cutting is a continued source of worry and discussion in every trade where proprietary articles are put on the market at fixed retail prices. Much can be said on the one hand in favour of competition and the rights of every trader to make a living where he can on his own margin of profit. But on the other hand, traders who do not indulge in the price-cutting practice feel that no person ought to carry on business in such a way as to undermine the credit of others. The effects of price-cutting, it is claimed, are to create the impression that most traders are overcharging and to lower the standard of profit throughout the trade. Price-cutting is considered for these and many other reasons to be unfair, and as such must be put a stop to.

The difficulty which chiefly hinders the suppression of the evil is that the law does not provide any short direct and comprehensive remedy for price-cutting as such. The law does not occupy itself with economic facts or with the particular difficulties of any one trade. The general view of the law is that every person is entitled to carry on any lawful business so long as he does not maliciously injure anyone else in so doing.

Accordingly, if A opens a shop and sells goods at the fixed retail prices, and then B opens a similar shop next door and sells the same class of goods at a lower price, the fact that all A's trade goes to B does not provide any problem which the law can settle. B may have ruined A, as many trusts and combines are said to have extinguished private traders, but A has no remedy at law; for what B does is merely lawful competition.

If a person carry on business with a view to maliciously injuring another, as when one trader steals or copies another's trade mark, or when one trader libels another's goods, the law allows the injured trader to take action for damages and an injunction.

Now few traders, even price-cutters, desire to deliberately injure others. The price-cutter is only out to get a business together in what he thinks is the easiest manner. It is useless, therefore, to think of catching him by making use of the general principle of law stated above. In order to stop the practice of price-cutting, traders must be put on such a special relationship towards each other as will give rise to new rights and obligations among the members of the trade.

Two methods have up to the present been tried with some success. One is the stop-list or boycott, the other the manufacturer's price-cutting agreement. Both these, however, have their flaws, and if used improperly involve the opponents of price-cutting in difficulties greater than ever.

Take first of all the boycott. To carry this out effectively, combination among the trade is necessary. All agree to stop supplying goods to any trader found indulging in any objectionable practice. "Stop-lists" have been the subject of several important cases during the last few years. And the Courts have always acted on the principle already mentioned, namely, that traders are entitled to boycott anyone they please so long as they do it fairly in the honest belief that it is to their benefit to do it. They must not libel the offender, nor must they act maliciously. The Courts have held that to put a man on the stop list is not of itself equivalent to libel, nor is it necessarily malicious.

There are two things which a trade association must avoid in using the stop-list method. Traders must not thereby be induced to break existing contracts. Traders may agree, by the rules of the trade association, not to supply any future orders to the boycotted trader, but once an order or contract has been accepted, it must be executed, even though in the meantime the person to whom the goods are to be supplied has been put on the stop list. If the trade association rules do not allow existing contracts to be carried out, it puts itself in the wrong, and becomes exposed to an action for damages on the part of the stop-listed trader, who can also sue the trader with whom the contract was made.

Further, trade associations must avoid inflicting fines upon persons who are not members of the trade association. The Motor Trade Association involved itself in difficulty a short time ago when one of its officers offered an offending trader the alternative, to being put on the stop list, of paying a substantial sum to the Association. The Court took the view that this amounted to extortion by threats, and convicted the officer with a nominal sentence.

Apart from the stop list, the only other course for suppressing price-cutting is the stringent use of the price-cutting agreement. This usually takes the form of

a clause in invoices or in contracts binding purchasers not to sell at less than the fixed prices. Reference may here be made to the case of Dunlop Tyre Co. *v.* New Garage and Motor Co., decided by the House of Lords in 1914.

The Dunlop Co. sold tires on an undertaking by dealers not to re-sell at less than list prices, and the dealers agreed to pay £5 for every tire sold in breach of the undertaking. The House of Lords held that such an arrangement was quite lawful.

The great difficulty in such a system is that an action has to be brought in each case against the offending trader, which involves considerable expense. Besides, each case must be capable of proof in evidence, and each separate case must be dealt with on its own merits, and each manufacturer must sue on his own account. One could not sue on behalf of the remaining members of the trade whose prices had been cut.

Moreover, the penalties in price maintenance agreements must be reasonable and only sufficient to cover the wrong done. In Dunlop's case, £5 was considered not excessive; but generally the tendency of the law is against penalties. The law has been authoritatively stated as follows: "Where a sum is agreed to be paid as damages on the breach of one of a number of stipulations of varying importance and the damage is the same in kind for every possible breach and is incapable of being precisely ascertained, the stipulated sum, provided it be a fair pre-estimate of the probable damage and not unconscionable, will be allowed." In other cases it will not, and the Court will only allow the plaintiff to recover what is reasonable.

The trouble is that the words "reasonable," "fair," "not unconscionable" are indefinite, and make it necessary to test each case on its own merits before it can be said whether a penalty is fair or not.

It is for these reasons, principally, that it is in the present state of the law difficult to find a really effective method for putting an end to the price-cutting evil.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.—The progress report issued by the British Electrical Development Association for the week ended October 30th shows that new local circles were formed in the following districts:—Rhondda, Norwich, Hampstead, Bedford, Hackney, Tunbridge Wells, Kingston-on-Thames, Twickenham, Keighley, Dudley, Worcester, and Swansea. An all-electric demonstration house was opened at Burnopfield (Durham), and others are in hand or in prospect at Birmingham (two), Denton (Manchester), Chester, Dundee, Edinburgh and Lincoln. All the circles in the North-East Coast area are endeavouring to arrange demonstration houses as quickly as possible. Forty-one meetings have been addressed by the district officers, and further meetings have been arranged at Evesham, Walsall and Kidderminster. The Southport Corporation has invited existing and potential consumers to call at its showroom for the competition booklet. The N.E. Coast Circles are co-operating in local newspaper advertising. Increased public interest is reported from Scotland; at Helensburgh an exhibition was well attended, and many booklets were distributed. It is stated that the campaign is bringing electrical interests together; at Bedford it has been the means of the starting-up of a local branch of the Electrical Contractors' Association. There appears to be a reluctance in some showrooms to give booklets to callers unless they present the newspaper coupon; while the coupon was intended as an introduction between the public and the contractors, it must not be regarded as an essential, but the name and address of the applicant should be secured. No. 4 of "Home Lighting News" is to be published almost immediately, and those concerned should read it and see that their staffs do so as well.

The all-electric house erected and equipped by the Leeds Electricity Department in connection with the Tercentenary Celebrations last July is being reopened to the public by the local committee for the campaign. Mr. C. N. Hefford, City Electrical Engineer, is chairman of the committee. The house will remain open to the end of March, and it is the first of a series of demonstration houses to be opened in various parts of the city and district during the winter, the plan being to arrange with building contractors for houses here and there to be electrically equipped during erection and, when completed, to be taken over by the Committee for some weeks and thrown open to public inspection. The Corporation Electricity Department has arranged to supply free energy during the demonstration periods and to supply the fittings on loan to the committee. The houses will be fitted with equipment which is within the reach of ordinary people and in accordance with the value of the house.

The British Electrical Development Association has decided to prosecute the campaign more vigorously in the Irish Free State by means of advertisements in two leading Dublin newspapers.

The Halifax Corporation Electricity Committee has agreed to supply electricity free of cost for demonstration purposes in the local campaign. The recommendation was opposed at a Town Council meeting, on October 27th, by Mr. E. Midgley, who suggested that when shopkeepers were prohibited from using light for display purposes, owing to the coal situation, the time was inopportune for the free grant of electricity for the proposed demonstration houses. Alderman Thos. Hey, chairman of the Electricity Committee, replied that the demonstration was to extend over six months, in four houses. The contractors were wiring the houses and bearing a cost quite equal to that of the Committee. The free energy would only amount to about 1s. per week per house. This small amount, of little consequence in the matter of the need for lighting economy, would no doubt be amply repaid by development of the domestic use of electricity in the town. The Council adopted the Committee's recommendation by a large majority.

The General Electric Co., Ltd., is, of course, taking a leading part in the campaign, and is devoting one of the windows of Magnet House, Kingsway, to a special campaign display.

A G.E.C. Campaign Window.

As our illustration shows, the prize-home poster is exhibited together with examples of the fittings depicted in the competition booklet. These are all numbered, and should aid many in selecting suitable fittings for the rooms pictured in the booklet.

B.T.-H. Tableaux.—THE BRITISH THOMSON-HOUSTON CO., LTD., was among the electrical companies which took part in the Industrial Pageant organised during the recent Manchester Civic Week. Its entry was a decorated motor van, upon which "Mazda" advertising was tastefully arranged. The company also participated in the Bart's Fleet Street Week procession with two vans—one displaying "Mazda" lamp posters and the other advertising "B.T.-H." radio valves.

Proposed German and Swiss Tariff Reductions.—The *Board of Trade Journal* for October 28th contained a list of articles which will be admitted into Germany at a reduced rate of duty if the commercial treaty between that country and Switzerland is ratified. The reduction will also apply to goods from the United Kingdom. The list includes a number of electrical items, such as impregnated cardboard insulation, meters, &c. Reciprocal reductions in the Swiss tariff are given in a separate schedule. One item affected is "electric carriages."

Electractors and Registractors.—In a leaderette entitled "Points in Registration," published in our issue of July 16th, 1926, we had the temerity to coin the words "electractors" and "registractors." It is interesting to note that a contemporary has awarded a prize to an entrant who submitted these two words. The Executive Committee of the N.R.E.I.C. has not seen its way to adopt either.

Unemployment.—There was a decrease of 15,832 in the number registered as totally unemployed during the week ended October 18th. At that date the total was 1,520,500, as compared with 1,536,332 on October 11th and 1,238,158 on October 19th, 1925.

The Tramway National Council.—The National Industrial Council for the Tramway Industry has resumed operations, after a period of suspension since the general strike. The trade unions represented have admitted that they were in the wrong in calling a strike without due notice and undertake to follow the correct procedure in future, by negotiating before any strike is called. The agreements existing before the strike are to remain in force. The question of reinstatement of employés who ceased work is to be left to the individual undertakings concerned.

Local Exhibitions.—NEWTON ABBOT.—We are informed by the Torquay borough electrical engineer (Mr. H. F. G. Woods) that the recent exhibition at Newton Abbot organised by his department was an outstanding success. Not only residents, but many people from outlying districts to which the Council is extending the mains, showed considerable interest in the exhibition. Local contractors lent their enthusiastic support and helped to arrange a very representative display. Cooking

The Torquay Electricity Department's Stand at its Exhibition.

demonstrations were given by the British Electric Transformer Co., Ltd., and modern water-heating apparatus was exhibited by the Bastian Meter Co., Ltd. The Electricity Department itself had a combined stand and inquiry bureau, which is illustrated in the accompanying picture. The price in Torquay for energy for domestic purposes is now ¼d. per kWh, less 5 per cent., which makes electricity, with all its other merits, a redoubtable competitor of coal and gas for cooking and water heating.

HELENSBURGH.—The exhibition held by the Clyde Valley Electrical Power Co. at Helensburgh proved highly successful, and Mr. Williamson, publicity and showroom manager to the company, has been congratulated upon the arrangements. In connection with the exhibition Mr. E. T. Goslin, general manager of the company, recently presented Mrs. Herbertson, wife of the convener of the Electricity Committee of the Town Council, with a "Sun-Ray" lamp as a memento.

Publicity Films.—Another exhibition of advertising films was given by Publicity Films, Ltd., at the Rialto Theatre, W., on Wednesday last week. Several notable advances in technique have been made since the last exhibition, emphasising the value of this means of advertising commodities. As before, interest is well sustained, and the productions are something more than advertisements. The films selected for exhibition included an excellent one produced for the gas industry—the *motif* being the ease of control of the new type of cooker. This is a subject to which the electric cooker should lend itself in a far more convincing manner. Only one "electrical" film was shown. B.T.-H. radio valves were the subject, and the title was "The Key to the Castle of Music." The film was a clever combination of animated cartoon and photography. The display was most impressive, and the method of treating each subject was admirable.

German Cable Works Agreement.—It has been reported that arrangements had been made which aimed at the establishment of a sales agreement between the German Cable Works Company, Berlin, the Rheydt Cable Company, the Hackethal Wire and Cable Company, and the Duisburg Cable Company, in each of which the Haniel family holds a large number of shares. On the other hand, it is stated that the arrangements merely concern a connection between the technical managers of the companies concerned for the purpose of working certain new patents on common account.

Brazilian Electrification Contract for British Company.—The October *Review* of the Bank of London and South America states that the contract for the electrification of the Mogyana Railway, Sao Paulo, Brazil, has been given to the English Electric Co., Ltd. The railway comprises nearly 2,000 km. of line, and it is announced that the entire system will be converted as soon as possible.

Electricity Supply Industrial Councils.—The Industrial Councils (both National and District) for the Electricity Supply Industry, which have been inoperative since the general strike in May last, have decided to resume their meetings. At a meeting of the West Midlands District Council, held at the Birmingham Chamber of Commerce on October 29th, the terms of the following agreement, which had been unanimously adopted by the National Council, were approved, and the District Council will resume its ordinary functions on the basis of the agreement, *viz.* :—

"That the agreements and machinery already in operation within the Joint Industrial Council, subject to any changes which may be mutually agreed from time to time, be continued.

"And as the Trade Unions represented on the National Joint Industrial Council have given undertakings attested by their general secretaries respectively, it is hereby further agreed, in accordance with Clause 10 ('Amendment of Constitution') of the constitution of the National Council, that:

"(*a*) In future there shall be no stoppage of work, either sectionally or nationally, until the cause of difference has been referred to the District and/or National Councils.

"(*b*) Any breach of the foregoing shall entitle the side of the Council not in default to give notice that the Council be forthwith dissolved, and upon the issuing of such notice the Council shall *ipso facto* be dissolved and all agreements or guarantees of agreements in operation at the date of such dissolution shall be abrogated.

"(*c*) All electricity supply undertakings which are represented through the employers' organisations shall be entitled to require that each employé now or hereafter engaged by them shall sign an agreement that his contract of service is in accordance with the terms and conditions agreed or approved from time to time by the National and District Councils."

Domestic Electrification in Ontario.—The September number of the *Bulletin* of the Hydro-Electric Power Commission of Ontario contains a review of the progress in the installation of domestic electrical appliances in Ontario during 1925. It is estimated that the increase in the aggregate installed domestic load during the year was over 50,000 kW, bringing the total up to about 850,000 kWh. Electric irons naturally lead the way, and the "saturation" percentage is 80.5. Figures for other appliances are as follows:—Electric toasters, 42.1 per cent.; air heaters, 29.3 per cent.; vacuum cleaners, 20.4 per cent.; washers, 17.7 per cent.; and cookers, 15.9 per cent.

An A.T.M. Exhibit at Liverpool.—One of the outstanding features of the industrial exhibition held in connection with the recent Liverpool Civic Week was the stand of the Automatic Telephone Manufacturing Co., Ltd. One section of the stand, which was a large one, was devoted to Strowger automatic telephony equipment, an actual 100-line exchange unit, forming a part of the Greater London installation, being

An A.T.M. Exhibit at Liverpool.

displayed among other things. The company's closed-circuit fire-alarm system was another exhibit. "Xcel" domestic electrical appliances were shown in a "kitchen" setting (*vide* our illustration). A cooker, a fire, an urn, and kettles were shown and daily demonstrations were given. Other sections of the stand displayed "Claritone" loud-speakers, telegraph apparatus, and mine- and railway-signalling equipment.

New York Electrical Exhibition.—The 19th Annual Electrical Exhibition was opened in New York on October 20th, three floors of the Grand Central Palace being utilised for the purpose. Although the exhibition is claimed to include over 20,000 electrical devices and appliances, domestic apparatus is prominent. In this department a great deal of attention is being paid to electric refrigeration. Other special features are an all-electric kitchen, an electric "beauty shop," radio receiving equipment, and electric trucks. The United States Government has a large display of naval and military electrical equipment, including what is claimed to be the largest searchlight in the world.

Shipley and Electrical Contractors.—At a recent meeting of the Shipley Electricity Committee a letter from the electrical contractors was read objecting to the arrangement whereby the wiring work in connection with various kinds of electrical appliances under the new hiring scheme is to be carried out by the Electricity Department. After full consideration, the Committee decided that the electrical contractors should be engaged to wire apparatus hired to consumers introduced by them, and that the chairman and engineer should be authorised to fix a scale of charges for the work.

G.E.C. Lighting in Australian Automobile Factories.—The General Motors Corporation, of the United States, has erected factories in Australia for the manufacture of motor-car bodies and assembling. It has placed orders with the British General Electric Co., Ltd., of Sydney, for approximately 1,200 lighting units and reflectors.

Trade Announcements.—The business hitherto carried on at 41, Call Lane, Leeds, as a branch of TUNGSTALITE, LTD., will in future be conducted as the UNITY LAMP AND ACCESSORIES, LTD. (registered office 43a, Great Charles Street, Birmingham). That concern is in no way connected with Tungstalite, Ltd. The London business of the latter company will be continued as heretofore. Mr. J. Bigley (formerly manager of the Leeds branch) will act as manager for the Unity Lamp and Accessories, Ltd.

THE DEAL AND SANDWICH ELECTRICAL CO., LTD., has opened showrooms and offices at 2, Park Street, Deal, and at High Street, Eastry. Catalogues of electrical and wireless apparatus are asked for.

MR. C. CARTER is shortly opening an electrical engineering and contracting business at 58, Duckworth Lane, Bradford.

THE SAXONIA ELECTRICAL WIRE CO., LTD., has appointed Mr. J. H. Berry, 72, Moor Street, Birmingham, as representative for the sale of its products throughout the whole of the Midlands.

With reference to the notice on page 726 of our last issue regarding the registration of TELEPHONE BERLINER (LONDON), LTD., Shipton Automatic Telephone System, Ltd., writes stating that this new company has been formed solely for dealing with the wireless side of the Berliner works. Telephone material of all kinds, and automatic telephone systems, are being dealt with exclusively by Shipton Automatic Telephone System, Ltd., the sole agents for Great Britain for the Berliner telephone apparatus.

THE STERLING TELEPHONE & ELECTRIC CO., LTD., announces that it has acquired the "Phonopore" business of Radio Phonopore & Electricals, Ltd. (in liquidation).

Catalogues and Lists.—THE MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—A coloured and priced poster advertising "Marconi" radio valves.

MR. ALAN WRIGHT, 124, Chancery Lane, W.C.2.—An illustrated price list of "Hazemeyer" terminal and joint boxes.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Leaflet F.4,097, describing "Geco" dispersive enamelled-steel reflectors for direct lighting. Priced.

MESSRS. HOPKINSON, LTD., Britannia Works, Huddersfield.—List No. 1,950, dealing with the company's patent spring safety valves.

MESSRS. PEACOCK, COBB & CO., 185, Deritend, Birmingham.—A wall card illustrating nine examples of "Tudor" chains for electroliers.

CALLENDER'S CABLE & CONSTRUCTION CO., LTD., Hamilton House, Victoria Embankment, E.C.4.—A well-illustrated descriptive catalogue of distribution appliances, comprising transformer, l.p. feeder, h.p. feeder, and tramway feeder pillars.

MESSRS. C. E. LUGARD & CO., Ashover, near Chesterfield.—A pamphlet containing details of the "Vulcan" universal machine tool.

BERRY'S ELECTRIC, LTD., 85-86, Newman Street, Oxford Street, W.1.—A loose-leaf catalogue of ironclad switchgear and switchboards. Fully illustrated and priced.

MESSRS. HOUGHTON-BUTCHER (GREAT BRITAIN), LTD., 88-89, High Holborn, W.C.1.—A general catalogue and an index received from the company form an encyclopædia of radio apparatus. The catalogue (233 pp.) is a complete guide to radio manufactures of all kinds, as well as small tools for radio work. The index (136 pp.) contains full retail prices and particulars of discounts of the material listed in the general catalogue. We have also received a "dealer's" catalogue which is of a comprehensive nature (124 pp.).

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—A very comprehensive catalogue (188 pp.) of radio apparatus of most British makes. The list contains full details, illustrations and prices of complete sets, components and accessories. Also an illustrated leaflet advertising the "Yale" flashlight.

THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—An instruction sheet for use with the company's Type B11 radio valve.

THE HART ACCUMULATOR CO., LTD., Stratford, E.15.—A November blotter advertising electric lighting batteries.

MESSRS. HEYES & CO., LTD., Water-Heyes Electrical Works, Wigan.—A priced and illustrated pamphlet dealing with the "Wigan" prismatic lamp fitting.

Bankruptcy Proceedings.—H. PADGETT and A. NICHOLSON, trading as Padgett & Co., 218, Spring Bank, and 10, Beverley Road, Hull, electrical and radio engineers.—The public examination of these debtors was held on October 25th at the Guildhall, Hull. The statement of affairs showed liabilities of £723, against assets of £190, leaving a deficiency of £533. Debtors attributed their failure to depression in trade and heavy business expenses. Padgett stated that he commenced business about four years ago, and he admitted that they had purchased goods after they were aware of their position. Stock which was estimated to be worth £100 only realised £27 when sold by auction. The examination was closed.

A. W. PEGRUM (trading as "Economia"), electrical contractor, 258, High Holborn, W.C.—The public examination of this debtor was held on October 27th before Mr. Registrar Warmington at the London Bankruptcy Court, the accounts showing liabilities of £4,511 (unsecured £4,273), and assets of £39, absorbed in preferential claims. In the course of his evidence, the debtor said that he commenced business in October, 1922, as a general merchant, and in 1924 changed it to that of an electrical contractor and decorator. In March, 1923, he and associates formed a limited company with the object of manufacturing and selling a patent electric grill; the company used his premises, and he was appointed a director, but only received two months' remuneration at £41 a month. The company was not a success, and was now dormant. The examination was concluded. The following are creditors:—

Unsecured:—	£		£
Armstrong, Whitworth and Co., Ltd.	214	Met. Electric Supply Co. ...	23
W. S. Bartlett	31	National Provincial Bank, Ltd.	71
Bastian Meter Co., Ltd. ...	37	J. F. Sprainger	500
Baxter & Caunter, Ltd. ...	58	C. S. Paulet	190
Callender's Cable & Construction Co., Ltd.	98	Christopher & Co.	23
Greig, Capt.	503	L. E. Hall	200
A. A. King-Farlow	313	Sir E. Illife	42
A. E. Lacey	160	J. H. Lyons	324
G. E. Llewellyn	500	F. Downham	135
		National Provincial Bank (partly secured, £72)	235

G. BOYD, New Road, Mouse Hill, Milford, Surrey, electrical engineer.—The following are creditors herein:—

	£		£
Hart Accumulator Co., Ltd. ...	43	Metro-Vick Supplies, Ltd. ...	70
Lyon, A., & Co.	32	Woodman, G. E.	77

G. WINTERSGILL, electrical engineer, Hawnby Road, Linthorpe, Middlesbrough.—First meeting held November 5th, at the Official Receiver's Offices, 80, High Street, Stockton-on-Tees. Public examination, November 19th, at the Court House, Middlesbrough.

B. E. DIXON (Creswick Dixon Electric Co.), electrical engineers, Bodega Buildings, High Street, 101a, Albert Road, 451, London Road, and 63, Chesterfield Road, Sheffield, and at Electric House, Knifesmith Gate, Chesterfield. Trustee, Mr. C. Turner, 155, Norfolk Street, Sheffield, released September 21st.

W. K. COXON (separate estate), trading together with E. WEARE as co-partners under the style of Western Manufacturing Co., wireless apparatus manufacturers, Nurshill, Lydney, Gloucestershire.—Last day for proofs for dividend, November 15th. Trustee, Mr. C. Latham, 78, New Oxford Street, W.C.

Company Liquidations.—GOOD BROS., LTD., electrical engineers, 35, South John Street, Liverpool.—A meeting of creditors was held recently at the offices of Messrs. Simon Jude & West, C.A., when the liquidator submitted a statement of affairs showing liabilities of £328, of which £243 was due to the trade and £85 to cash creditors. The assets were estimated to realise a net amount of £34, leaving a deficiency of £294. The company was registered in May, 1922, with a nominal capital of £3,000, for the purpose of taking over an existing business. It had been engaged chiefly in the manufacture of patent lamp shades, and a considerable sum was spent in advertising and experimenting, and practically the whole of the capital was absorbed. A resolution was passed confirming the voluntary liquidation of the company, with Mr. West as liquidator. The following are creditors:—

	£		£
Electric Lamp Factors	43	Dickinson, S.	26
Lightfoot, J. A.	14	Simon, Jude & West	39
Willis & Bates	41	Bankers	85

THE LIGHT O' DAY ELECTRIC LAMP CO., LTD.—A meeting of members is called for November 30th, at 34-36, Gresham Street, E.C., to hear an account of the winding up from the Liquidator, Mr. C. S. Steel.

F. HULSE & CO., LTD.—A meeting of creditors is called for November 12th, at the Leeds Law Institute, 1, Albion Place, Leeds. Liquidator, Mr. C. C. Murgatroyd, 1, Cookridge Street, Leeds.

A. C. ALEXANDRA & CO., LTD.—Last day for proofs for dividend to preferential creditors, November 13th. Liquidator, Mr. G. D. Pepys, Official Receiver, Carey Street, W.C.2.

Dissolutions of Partnership.—RELIANCE ENGINEERING CO., electrical engineers, 339a, Richmond Park Road, East Sheen.—Messrs. T. Wheeler, A. Chaplin and E. Pobjoy have dissolved partnership. Mr. Pobjoy will attend to debts.

PARSONS & SOTHERS, electrical engineers, 156, Hockley Hill, Birmingham.—Mr. H. Parsons and Mr. C. A. Sothers have dissolved partnership. Mr. Sothers will attend to debts and continue the business at the same address.

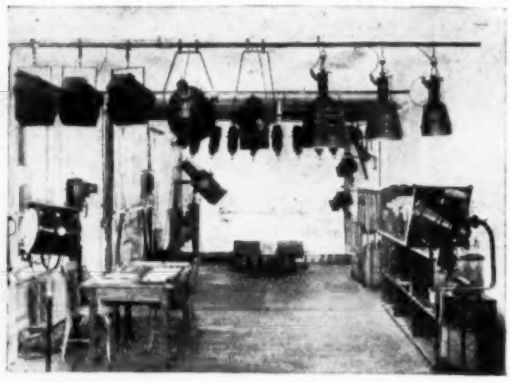
ELYSIUM GARAGE, automobile and electrical engineers, 60a, High Street, Streatham, S.W.—Mr. W. A. Catherwood and Mr. S. H. Audrey have dissolved partnership. Mr. Catherwood will attend to debts and continue the business.

Australian Duties Deferred.—The Australian Customs authorities have further postponed the date for the enforcement of import duties on radio valves until January 1st, 1927.

National Wireless Week. — Manufacturers of radio apparatus and other interested parties have decided that next week (November 7th to 13th) shall be a "National Wireless Week" and the co-operation of the British Broadcasting Co., Ltd., has been gained. In connection with this the Marconiphone Co., Ltd., has prepared special publicity matter for the use of retailers. The company also announces that it has taken up the marketing of Mansbridge-type fixed condensers.

Mr. Samuel on the Outlook.—In the course of a speech at a luncheon of the Glasgow Chamber of Commerce last week, Mr. A. M. Samuel, Parliamentary Secretary of the Department of Overseas Trade, said that although the decline of £83,000,000 in exports during the first nine months of this year was serious, an examination brought out some less discouraging factors. If allowance were made for price changes the fall in volume was not so serious. Exports of goods other than coal were maintained for a time to a surprising degree. The end of the coal dispute would no doubt lead to a recovery in trade, but he deprecated any talk of a "boom." Mr. Samuel also mentioned with satisfaction the strengthening of commercial relations between this country and the Dominions.

Stage-Lighting Showrooms.—The General Electric Co., Ltd., has recently opened well-equipped showrooms for the display of stage-lighting apparatus at Central House, Kingsway (next door to Magnet House). These showrooms are available to architects, consulting engineers, contractors, and others



The New G.E.C. Stage-Lighting Showroom.

interested in the stage lighting of theatres, kinemas, dance halls, cabarets, &c. Stage-lighting engineers are in attendance at all times to advise on technical matters, or to prepare and submit stage-lighting schemes of any magnitude. Adequate stocks of equipment are kept.

Electrical Manufacturing in Australia: Important Decision.—A *Reuter* dispatch from Melbourne states that on November 1st the Full High Court, by a unanimous judgment, found that the Commonwealth Shipping Board had no power to compete with private firms in the manufacture of electrical machinery.

United States Electrical Exports.—*Commerce Reports* has published preliminary figures of electrical exports for the United States during August. These show a total of $7,024,671, a decrease of $1,019,621 from the August, 1925, total. There was a large increase in the export of telegraph apparatus, and other items which rose in value were telephone apparatus, d.c. generators, electric locomotives, primary batteries, domestic appliances, electrical porcelain, bells and buzzers, insulated iron and steel wire and cable, and bare copper cables. The export of d.c. generators declined considerably—the total falling from $200,826 to $20,605. Other items which recorded decreases were motors, steam turbo-generator sets, generator accessories and parts, storage batteries, transformers and converters, transmission and distribution equipment, radio apparatus, ignition equipment, signalling materials, and insulated copper cables.

Australian Radio Trade.—It is reported that an important combination of the wireless retail trade in Melbourne has been completed in a manner which is likely to check the price-cutting which has occurred for some time in various kinds of wireless equipment, especially receiving valves. It is stated that one of the largest wireless importing firms, which is also engaged in the retail business, has obtained a controlling interest in three of the largest independent retail establishments. Though trade has always been excellent, the extent to which prices have been cut recently has caused concern. It is understood that an endeavour will be made to gain control of other retail trading houses shortly.—*Reuter's Trade Service* (Melbourne).

Traders' Protest.—At the quarterly meeting of the Council of the London and Suburban Traders' Federation held on October 26th, at the Westminster City Hall, it was decided to send a protest to Messrs. Hoover, Ltd., against their giving the sole agency of the district for the sale of their vacuum cleaners to the Hackney Borough Council, to the detriment of local traders.

Radio Exhibitions.—Dublin.—Mr. J. J. Walsh, Minister for Posts and Telegraphs of the Irish Free State, opened the wireless exhibition held by the Irish Association of Radio Traders in Dublin on November 1st. The usual programme from 2RN will be delivered from a room at the show. The General Electric Co., Ltd., is amongst the exhibitors.

Manchester.—The radio show promoted by the *Manchester Evening Chronicle* was opened on October 26th by Sir William Noble, a director of the B.B.C. It is the third annual show, and amongst those taking part in it are Metro-Vick Supplies, Ltd., the Marconiphone Co., Ltd., and the Igranic Electric Co., Ltd.

Book Notices.—The arrival of the *Punch* Almanack is always a welcome reminder that Christmas is not far off. That just to hand for 1927 is excellently produced and in our opinion is happier than usual in its humour. A good shillingworth of unrationed warmth.

"Successful Crystal and One-Valve Circuits," by J. H. Watkins. Pp. xi+104; figs. 86. London: Sir Isaac Pitman and Sons, Ltd. Price 3s. 6d. net.

"Engineering Abstracts," New Series. No. 29. October, 1926. London: The Institution of Civil Engineers.

"Science Abstracts (A and B)", Vol. XXIX. Part 10. October 25th, 1926. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

English Mechanics and the World of Science and *Amateur Mechanics* have been amalgamated and are now appearing as *English and Amateur Mechanics*, at threepence weekly.

German Electrical Trust Rumours.—Rumours continue to be put in circulation in Germany concerning the proposal to form an electrical trust. The persistence of the rumours leads to the assumption that some basis exists for them, although no one outside of circles directly interested could possibly give any definite information. But taking into consideration the existence of a chemical trust, the recent formation of a steel trust, and the similar schemes for wagons, if not locomotives also, it would not be surprising to hear of a big scheme being launched for the constitution of an electrical trust. Apparently this would be promoted by the makers themselves, as with the credits obtained from abroad in recent years the German banks are said no longer to possess the influence over the electrical manufacturing industry which they did some twelve years ago.

A Large Crane Order.—Messrs. Stothert & Pitt, Ltd., have recently received an order for 36 electric level-luffing cranes for loading and discharging vessels at the new docks of the Santos Dock Company.

Another Anglo-German Conference Proposal.—It is reported that the Federation of British Industries has addressed to its counterpart in Germany an invitation to a conference in London, and it is understood that the Federation of German Industries has indicated acceptance. It is proposed to discuss the question of co-operation between the two organisations on broad lines.

Social Events.—A dance given by the directors of the Mullard Associated Companies to the employés and guests of the companies, was held at the Horticultural Hall on October 15th. About a thousand guests were present, and the opportunity was taken to make a presentation to Mr. and Mrs. S. R. Mullard, which consisted of a silver rose bowl and two silver vases from the employés at the works. A bouquet was presented to Mrs. Mullard, and also an Irish terrier puppy, by Messrs. Arks Publicity. Mr. Mullard thanked the gathering on behalf of himself and his wife.

The Greater London Division of the Electricity Supply Commercial Association held a dance in the Great Hall, Cannon Street Hotel, on Wednesday evening last.

New French Companies.—Among the new electrical engineering concerns recently formed are the Compagnie Internationale d'Electricité (70, Rue de l'Aqueduc, Paris), capital 100,000 fr., to manufacture electric lamps and apparatus; La Société Française du Fer Electrolytique (57, Rue Pierre Charron, Paris), capital 2,250,000 fr.; and La Société d'Electrification Omnia, Gautereau Bayle & Cie. (89, Rue de Flandre, Paris), capital 250,000 fr.

The Radio Demonstration Van.—The radio demonstration van equipped with "Mullard," "Amplion," and "P.D." radio products, to which we have made reference in past issues, recently completed a tour of 4,342 miles in the West of England. We have received a poster giving the names of prize-winners in a mileage-guessing competition promoted in connection with the tour.

The Economic Position of British Engineering Industry.—The British Engineers' Association has this week published a monograph on the economic situation of British engineering industry, which has been prepared at the special request of the Preparatory Committee of the Economic Conference of the League of Nations, for submission to the Conference at Geneva. The monograph contains, within its 75 pages, a review of the present-day problems and prospects of the engineering industry, and many statistical tables and graphs. The Association states that: "In view of the basic importance of engineering industry and the extent to which other trades and industries, and the finances of the country, are involved in its fortunes, it is believed that the facts presented will be of interest to all concerned in manufacturing, commerce or finance. It is not a political document, and the facts are frankly disclosed and commented on in the belief that their dissemination will do more good than harm."

Aluminium Production in Norway.—With reference to the paragraph under this title in our issue of October 22nd (p. 688), the allusion to Mr. Tod should have read: "Mr. Robert P. Tod, late manager of the British Aluminium Co." To avoid confusion it should be stated that the company forming the A/S Haugvik Smelteverk, Glomfjord, Norway, is the Aluminium Corporation, Ltd., and not the British Aluminium Co

Fuller's United.—We are informed by FULLER'S UNITED ELECTRIC WORKS, LTD., whose liquidation proceedings were recently reported here, that the accumulator department has been acquired by Mr. E. W. Sudlow, F.C.I.S., late secretary of the company, Mr. A. P. Welch, late chief technical engineer, and Mr. H. F. Wynn, late general sales manager. A company is shortly being registered under the name "Fuller Accumulator Co. (1926), Ltd.," and there will be no break in the continuity of manufacture of the accumulator. The wire and cable department of the company has been sold and will, it is stated, be run on a larger scale than in the past. Sir John Mann, K.B.E., will continue for the present to act as receiver and manager in connection with the ebonite and carbon block departments of the company.

"Cosmos" Cookers for Manchester.—METRO-VICK SUPPLIES, LTD., has received an order from the Manchester Corporation for a twelvemonths' supply of "Cosmos" medium-sized cookers fitted with the company's new totally-enclosed boiling plate. The first order is for 80 cookers.

New Australian Company.—The AUSTRALIAN WIRELESS CO., LTD., has been formed in Sydney, with a capital of £25,000, to acquire an existing radio apparatus business.

For Sale.—The South London Merchandise Mart will sell by auction on November 18th, at 10, Red Lion Passage, Red Lion Square, W.C., a contractor's stock of electrical and wireless goods. Mr. J. H. Shaw will sell by auction on November 10th, at 85, Newington Causeway, S.E., the stock and material of a leading accumulator works. (See our advertisement pages to-day.)

Lighting and Power Notes.

Adwick-le-Street.—STREET LIGHTING.—The Urban District Council is to have plans prepared for a comprehensive scheme of street lighting by electricity to include Highfield Footpath, Skellow New Village, Woodlands East, and the housing estate.

Barrow.—LOAN.—At a meeting of the Town Council on October 25th, the Electricity Committee recommended that application be made for sanction to the borrowing of £16,000 for the following purposes:—Services, £3,500; meters, £2,000; apparatus, £10,000; l.p. switchboard and connections, £500.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—It is announced that work is to commence immediately on the third stage of the development of the West Kootenay Power & Light Co.'s hydro-electric plant on the Kootenay River near Lower Bonnington Falls. The scheme will provide an additional 60,000 h.p.

Clitheroe.—ELECTRICITY SUPPLY.—The first cable in connection with the supply of electricity for the district was laid on October 28th, and supplies will be available in the New Year.

Continental.—SWITZERLAND.—The Société des Forces de Joux is constructing a new power station at the junction of the Avançon des Plans and the river of the same name rising at Anzeindaz. The plant will include four sets of 5,000 h.p., and one of 3,000 h.p. Electricity will be generated at a pressure of 5,000 V, and be transformed at first to 60,000 V and later to 120,000 V. It is hoped that the power station will be completed and in operation by 1928.

ITALY.—According to officially published figures of the latest census of the number of hydro-electric stations in operation in Italy at December 31st, 1925, there were 588 with a total capacity of over two million nominal h.p. and 95 stations with a total of one million nominal h.p., were under construction. The reserve power obtainable from reservoirs equals about 1/10th of that obtainable from the hydro-electric stations in operation (the production of electricity in 1925 being estimated at approximately 7,000 million kWh). The reservoirs still under construction number 27, with a nominal productive power of 1,000 million kWh.

GERMANY.—The recently-issued report for 1925 of the Berlin Electricity Supply Co. shows that during the year the number of consumers increased from 273,787 to 369,205, and the output of the power stations from 462,600,000 kWh to 661,700,000 kWh. In order to meet the increasing demand, the plant at the existing Moabit and Rummelsburg power stations had to be extended while the Charlottenburg station is being reconstructed. Additional transformer stations are being established in various parts of the city, necessitating an increase of 88 miles in the 30-kV distribution mains, 100 miles in the 6-kV system, and 440 miles in the l.p. system.

BELGIUM.—The recently-issued report of the Compagnie d'Electricité de la Dendre shows that the sales of electricity during the year ended June 30th last amounted to 18,673,990 kWh, as compared with 16,787,390 kWh in 1924-25. The company is now supplying electricity to 77 communes, and has 219 miles of h.p. and 270 miles of l.p. mains. An order has been placed for a further 7,200-kW turbo-generators. The company has been experimenting with the use of pulverised fuel firing. Two boilers which were at first fitted with the system have proved satisfactory, and a third boiler is to be adapted to this system.

Dulverton.—ELECTRICITY SUPPLY.—At a recent meeting of the Rural District Council a communication was read from the Dulverton Electric Lighting Co., Ltd., stating that the company was applying for a Special Order covering the whole of the rural district of Dulverton, the urban district of Wiveliscombe, and the town of Milverton. The company proposes to erect a hydro-electric power station to utilise the resources of the watershed of Exmoor. Pending the establishment of these works, it is proposed to improve the present plant for the supply of Dulverton. The proposed maximum charge would not exceed 10d. per kWh. Notice was given of a motion for the next meeting that the Council consent to the application.

Huddersfield.—LOANS SANCTIONED.—The Town Council has received sanction to a loan of £19,000 for transformers and mains, and also to a loan of £32,500, on account of £43,680 applied for in connection with the linking-up with Halifax.

Liverpool.—LOAN SANCTIONED.—The Electricity Committee has received sanction to the borrowing of £36,737 for building work and plant at Paradise Street and Fairclough Lane stations.

London.—SOUTHWARK.—The Electricity Committee has recommended that in connection with the question of plant extension *versus* bulk supply, the Electricity Commissioners be informed that the Council is advised that if a bulk supply is taken on the terms offered, the cost to the Council for equal plant capacity and output would be from £8,000 to £10,000 per annum more than if the same output were generated locally, and that as the Commissioners have not furnished any information showing how the best interests of the borough would be served by taking a supply in bulk, they be requested to reconsider the matter with a view to sanctioning the Council's plant extension scheme.

HORNSEY.—The Electricity Committee has received sanction to the borrowing of £5,000 for electricity purposes. The Committee has authorised mains extensions at a cost of £1,100.

ST. PANCRAS.—The new boiler-house extension at the Borough Council's electricity works was formally inaugurated by Sir Alfred Mond, M.P., on November 1st.

Manchester.—LOANS SANCTIONED.—The Electricity Committee has received sanction to the following loans:—Main transmission lines, £90,000; feeders, £36,500; distributors, £100,000; plant (sub-station equipment) and building work, £7,500; Barton station—buildings, £150,000; plant, £400,000.

Newcastle-on-Tyne.—ELECTRICAL DEVELOPMENT.—The Newcastle-upon-Tyne Electric Supply Co., Ltd., informs us that since January 1st last it has connected 12,000 new consumers to its system, this being more than double the number connected in any previous year.

Nuneaton.—INQUIRY DECISION.—In connection with the inquiry held by the Electricity Commissioners in June last into the application of the Corporation to extend its generating station in preference to taking a bulk supply from the Leicestershire and Warwickshire Electric Power Co., Ltd., the Commissioners have informed the Corporation that they are not satisfied that the Corporation could supply cheaper electricity by extending the plant than by purchasing a bulk supply from the company, and therefore they are unable to sanction the proposed extension.

Oldham.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction to a loan of £50,000 for mains.

Paisley.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer, Mr. W. Blair Smith) for the year ended May 15th last, show a total income of £78,046, as compared with £92,108 in the preceding year. Working expenses amounted to £55,485, as against £53,808, leaving a gross surplus of £22,561 (£38,299), to which was added a balance brought forward from the preceding year of £4,362, making a total of £26,923. Capital and other charges amounted to £38,020, and there was a net deficit for the year of £11,097, which was met by a sum transferred from reserve. The capital expenditure during the year amounted to £66,416, the bulk of which was expended on mains. The electrical energy sold decreased from 10,605,733 to 9,210,538 kWh.

Price Increases.—Owing to the higher cost of coal, increases in the charges for electricity have been made or recommended in the following districts:—

AYRSHIRE.—*The Ayrshire Electricity Board.*—An increase of 10 per cent.

GALASHIELS.—*The Galashiels and District Electric Supply Co., Ltd.*—An increase of 10 per cent.

WOLVERHAMPTON.—An increase of 10 per cent.

LANCASTER.—An increase of 25 per cent.

Plymouth.—LOAN SANCTIONED.—The town clerk reported at a recent meeting of the Corporation Electricity Committee, that sanction had been received to the borrowing of £37,835 for a new turbo-alternator and switchgear at the Prince Rock power station. The Committee approved a considerable number of cable extensions in various parts of the borough, and

agreed to the laying of a cable at a cost of £1,878 to the Higher Venn estate, which is being developed for building purposes, provided assurance was given that the houses would be electrically equipped.

St. Helens.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer, Mr. F. N. Rendell Baker) for the year ended March 31st last, show a total revenue of £119,672, as compared with £113,483 in the preceding year. Working expenses amounted to £79,477, as against £69,233, leaving a gross profit of £40,195 (£44,250), to which was added revenue from other sources, making a total of £41,240. After deducting capital charges there was a net profit of £10,414, of which £10,239 was transferred to reserve and the remainder carried forward. The previous year's working resulted in a surplus of £21,809. The capital expenditure during the year amounted to £78,157, and included £43,004 for machinery and £21,510 for mains and services. The sales of electrical energy increased from 32,063,210 to 33,213,518 kWh.

Special Orders. — The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Urban District Council of Clayton to supply electricity in the urban district, and the West Ham Corporation to supply electricity in bulk to the East Ham Borough Council and Ilford Urban District Council.

Application has been made to the Commissioners by the Ripon City Council for a Special Order authorising it to purchase electricity in bulk and to distribute it in the city and in parts of the rural districts of Ripon and Wath.

United States.—ELECTRICAL DEVELOPMENT.—According to the *Electrical World* the Associated Gas and Electric Company estimates the total expenditure for new construction at $14,547,500. Included in the development scheme is $1,541,000 for another 15,000-kW set for the Staten Island Edison Corporation, to be installed at its Livingston plant; and the appropriations for five new sub-stations for the Penn Public System, besides two new links in this company's 132,000-V transmission line to Niagara and the extension of its 110,000-V line northward from Union City, Pa., to Erie.

The coming expenditure of approximately $4,000,000 for new equipment and buildings at the Riverton (Kan.) power plant of the Empire District Electric Company is announced. Improvements include the installation of a 26,250-kW turbo-generator with auxiliary equipment. This machine is to be ready for operation by January, 1928, and will bring the rating of the plant, which is the largest in Kansas, to approximately 100,000 kW.

Uruguay.—HYDRO-ELECTRIC DEVELOPMENT.—According to the *Bank of London and South America Monthly Review*, several years have passed since the original deliberations took place in Government circles regarding the possibility of obtaining hydro-electric power from the Rio Negro. The scheme, however, has lately been taken up by the Executive Council, which, in a message to the Chambers, has forwarded for their attention a Bill which would permit the Council to sign an *ad referendum* contract with a foreign engineer to draw up a complete project of the proposed works. In a report prepared by one of the councillors it is estimated that the execution of the works would involve an outlay of some $21,000,000, and that the energy to be derived annually would be equivalent to that produced by the consumption of 800,000 tons of coal, being over double the power actually employed in the country.

Wakefield.—INAUGURATION OF NEW PLANT.—The new 7,500-kW set which has recently been installed at the Corporation's electricity works was formally put into operation by the Chairman of the Electricity Committee on October 27th. This extension brings the total capacity of the power station up to 15,750 kW.

Willington (Co. Durham).—STREET LIGHTING.—The Urban District Council has had under consideration a scheme submitted by the Durham Electrical Power Distribution Co., Ltd., for lighting the streets by electricity. The scheme comprises 126 street lighting units, the estimated cost of installation being £2,850. The Works Committee has been instructed to obtain particulars of cost of supply and maintenance in adjoining districts.

Tramway and Railway Notes.

Blackpool.—TRAMWAY IMPROVEMENT.—At a meeting of the Town Council on October 28th, a recommendation of the General Purposes Committee to construct a double tramway track in Talbot Road in place of the existing single track was approved. The cost is estimated at £10,000.

Bradford.—RAILLESS CARS.—The Corporation Finance Estimates Sub-Committee has had an interview with the chairman of the Tramways Committee and the general manager on the Committee's proposal to establish a railless-car service on the Allerton route instead of relaying the tramway track, and has decided to defer further consideration of the proposal for two months.

TRAMWAY DEPOT FIRE.—Damage estimated at £5,000 was caused by fire at the Corporation's chief tramway depôt at Thornbury on the night of October 26th. The fire occurred in the repair workshop. Three of the cars in the shed for repairs were completely burnt out and a number of others were damaged. The workshop had been locked up four hours before the fire was discovered, and the cause of the outbreak is not known.

Brazil.—RAILWAY ELECTRIFICATION.—A contract for the electrification of part of the West-of-Minas railway, between Barramansa and Augusto Pestanha, a distance of 73 km., has been signed. It is understood that one tender only, from the Metropolitan-Vickers Electrical Co., Ltd., was received. A hydro-electric power station is to be erected at the Pilões waterfall to provide the necessary electrical energy for the line. The contractors have undertaken to complete the work within 16 months from the date of commencement.—*Reuter's Trade Service* (Minas Geräes).

Continental.—ITALY.—The Government has appointed a Commission, which has already started work, to study and report on the best form of construction for underground transport to relieve the surface traffic in Rome. The scheme calls for a number of lines, with a total length of 27 miles, radiating from a common centre to serve all sections of the city. The work, which is expected to take ten years, will be entrusted to local contractors only. It is hoped that the gradual completion of this underground railway will permit of the removal from the streets of the tramways.—*Reuter's Trade Service* (Rome).

GERMANY.—The directors of the Reich Railway Co. have commenced to place orders in connection with the conversion of the Berlin city railway to electric traction, a sum of 130,000,000 marks having been assigned for this purpose. In the first place orders have been given to the A.E.G. and the Siemens concern for the delivery of 1,500 d.c. motors of the value of 13,000,000 marks, and to the Bergmann Company for the supply of controlling apparatus for 4,000,000 marks. Further orders are expected to be placed in the near future.

Costa Rica.—RAILWAY ELECTRIFICATION.—A contract has been signed between the Government of Costa Rica and the A.E.G., of Berlin, for the electrification of the State-owned Pacific Railway running from San José to the port of Puntarenas. The length of the line is about 80 miles.—*Reuter's Trade Service* (San José).

Croydon.—YEAR'S WORKING.—The report on the working of the Corporation tramway undertaking (manager: Mr. T. B. Goodyer) for the year ended March 31st last records a total income of £111,134, as compared with £112,685 in the preceding year. Working expenses amounted to £132,954 and recoverable expenditure charged to revenue £2,366, making a total of £135,321, as against £145,333, leaving a gross deficit of £24,177 (£32,649). Capital charges absorbed £32,211, and there was a net loss of £56,388, as compared with a deficit of £58,837 in 1924-25. The car mileage decreased from 2,570,542 to 2,515,633, but the number of passengers carried increased from 19,552,621 to 20,686,921.

London.—UNDERGROUND WINTER SERVICES.—A programme providing for a general "speed-up" on the District Railway has been introduced by the Underground Company. The programme will continue to operate throughout the winter months and will be subject to still further augmentations during the Christmas shopping weeks.

NEW TICKET MACHINE.—New slot ticket machines which will print tickets and provide change are to be installed at several Underground stations.

TRAMCAR EQUIPMENT.—The Highways Committee of the L.C.C. has approved the provision of overhead trolley gear for 100 tramcars at a cost of £6,250.

Liverpool. — NEW ROUTES.—In its next application to Parliament, the Corporation will seek powers for the construction of the following tramway routes:—(*a*) A line from Warbreck Moor to the Old Roan Bridge, a length of 1,600 yards. (*b*) A line commencing by a junction with the existing tramways in Church Road, Wavertree, to Rose Brow, a length of over two miles. (*c*) A line commencing by a junction with the existing tramways in High Street, Wavertree, to Childwall Abbey Road. The length of this line would be about 1¼ miles.

LOANS.—The Tramways Committee is to make application to the Minister of Transport for sanction to the borrowing of the following amounts:—New offices, works, and car shed at Edge Lane, £100,000; additional cars, £74,000; additional omnibuses, £18,000.

Telegraph and Telephone Notes.

Anglo-Continental Telephony.—NEW CABLES.—Telephone communication between England and the Continent has been greatly improved during the past 10 months. A through service to Germany is being provided, by way of Holland, on the two latest cables from Aldeburgh to Domburg, in Walcheren; both carry Dutch as well as German wires. In addition, an Anglo-Belgian cable of still larger dimensions has been laid, and another of similar capacity will shortly be laid between Sandgate and Audresselles, in France; both should be ready for use early in the New Year. The Franco-Swiss land cable is nearing completion. It is connected with two or three circuits of the latest Anglo-French cable, and will thus provide a direct service between this country and Switzerland. Telephone services connecting Austria and Czecho-Slovakia with England are under contemplation.

Australia.—RADIO-TELEGRAPHY.—At the annual meeting of Amalgamated Wireless (Australasia), Ltd., Mr. Allard, chairman, said that the "beam" wireless service to England would

be opened for public traffic early in the New Year. The Marconi Company's engineer who tested the Canadian plant had arrived in Australia. The directors anticipated the new service with confidence. The company had constructed the principal Australian broadcasting stations. Mr. Fisk, managing director, referred to the company's successful manufacture of special short-wave apparatus for the use of ships, enabling the recent record communication to be made between Sydney and the steamship *Jervis Bay* at a distance of 10,000 miles. He said that no ship trading between Australia and England had before maintained communication beyond Colombo on the Suez route, and Durban on the Cape route. These valuable results were obtained by an Australian ship with Australian apparatus and Australian operators. The company was publishing a daily newspaper, *Australia-England*, on the Commonwealth Line steamers. Since the New Caledonia cable was disconnected a wireless service had been maintained at Noumea, and also in Papua, New Guinea. These services, with a coastal station, a powerful broadcasting station, a wireless telephone station communicating with trawlers, and a feeder station for the "beam" service would be concentrated at Pennanthills, Sydney.—*Daily Telegraph*.

The vessel is reported by the *Evening News* to have never lost touch with the Jervis Bay 0.25-kW station throughout her 12,000-mile voyage from Sydney to Plymouth. Mr. Victor M. Brookes is the ship's chief wireless operator.

Greece.—NEW WIRELESS STATION.—*Reuter's* agency learns that it is officially stated that the Eastern Telegraph Co. has entered into an agreement with Marconi's Company for the erection of a wireless station in Greece. This statement follows the announcement made a short time ago that the Eastern Telegraph Co. had secured a concession from the Greek Government for a joint cable and wireless service in substitution of its former cable concession. The Eastern Co. immediately invited tenders for the erection of the wireless station and, as a result, the agreement with Marconi's Company has been made for erecting the station, which will be operated by the Eastern Telegraph Company.

Hull.—TELEPHONE SERVICE.—At a recent meeting of the Hull Corporation Telephones Committee the manager (Mr. T. Holme) reported that the Committee in June sanctioned the extension of the automatic equipment at a cost of £38,525, and it was decided to pay £28,525 out of the reserve fund and apply for loan sanction for £10,000, and it would be necessary to apply in the autumn for loan sanction for the extension of the instrument and wire plant; the Ministry of Health wished the Corporation to make one application to cover the three items. The extension of the system by the addition of 1,000 instruments sanctioned by the Committee in October, 1925, had been practically completed, and he submitted an estimate of the cost of a further extension of the system by 1,000 instruments amounting to £38,700, including the £10,000 for automatic equipment. The Committee approved the recommendation. The chairman (Alderman E. Ombler, J.P.) said it would be necessary to borrow some of the money. If the Corporation had not to pay royalties it could have met the expenditure out of revenue.

New Pacific Cable.—LAYING COMMENCED.—The cableship *Dominia* has started laying the shore end of the new Pacific cable to Fanning Island.—*Reuter* (Vancouver, October 27th).

The Telephone Service.—UNDER-LONDON CALL OFFICES.—Arrangements have been made by the Post Office with the railway companies to install underground telephone call offices at interchange tube stations where the passenger traffic from one route to another is heavy. For a beginning, call boxes are being erected at Leicester Square and Oxford Circus stations.

Radio Notes.

Germany.—NEW STATION.—A new broadcasting station, the power of which is not to exceed 1.5 kW, has been sanctioned by the Interallied Rhineland Commission for erection near Hoch-Speyer in Westphalia.

India.—CALCUTTA STATION SITE.—The Calcutta Improvement Trust, after having considered an application of the Indian Radio Telegraph Co., Ltd., for leasing a site for the erection of a broadcasting station, formed the opinion that there would be no objection to the location of a station in the Cossipore-Chitpore Park, and it was left to the chairman to discuss with the Radio Co. the actual site and the terms on which the lease should be granted, after which the matter was to be again placed before the board.

Portugal.—GOVERNMENT BROADCASTING.—The Portuguese Government intended to start this week broadcasting a daily bulletin of political and other information, which will be audible within a radius of 900 miles; the service will start at 11 o'clock each night. The Government will also use this means of speaking directly to the nation when occasion requires. English people may be surprised at the hour at which broadcasting is to begin, but it must be pointed out that the Portuguese, as a rule, rise late in the morning, and dine about 9 p.m., so that their evening does not begin until about 10 p.m.—*Reuter* (Lisbon).

Spain.—POSSIBLE MONOPOLY.—The Union Radio of Madrid has acquired the two broadcasting stations in Seville and the Cadiz station. It is endeavouring to secure a monopoly, and is said by *Commerce Reports* to be backed by the Sociedad Espanola del Acumulador Tudor, Sociedad Iberica de Construcciones Electricas, and the German A. E. G. interests, all operating from Madrid; other organisations are making bids for the monopoly.

Sweden.—LICENCE PROLONGED.—The Government has prolonged the licence of the Broadcasting Co. ("Radiotjänst," Ltd.) to the end of 1927, says *World Radio*. The transmitting plant is owned by the Government, and is worked by the engineers of the Telegraph Board. An important change has been made as to the division of the licence income. The listener pays a fee of 10 Swedish crowns, of which the Telegraph Board has 5 cr. and the "Radiotjänst" 5 cr. Now the "Radiotjänst" is to be granted only 3.72 crowns, the remainder being taken by the Telegraph Board for technical purposes. The building of the new high-power station, which is to be opened next spring, and also the erection of all relay-stations have been so expensive for the Telegraph Board that it is in need of all the money it can get. "Radiotjänst" has been working since the beginning of 1925, and the number of listeners has risen to 212,000 during this time.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice appeared in our advertisement pages.)

Open.

Adwick-le-Street. — November 10th. Urban District Council. Internal wiring in 264 Council houses. (October 29th.)

Australia.—MELBOURNE.—January 4th, 1927. P.M.G.'s Department. Bells and buzzers. (B.X. 2984.)*

SYDNEY.—January 26th, 1927. New South Wales Government Railways. Electric railway car equipments, consisting of motors, control equipment, air compressors, pantographs and accessories (Spec. 1065). Chief Mechanical Engineer, Wilson Street, Redfern.

Municipal Council. December 1st. Tungsten filament electric lamps. (B.X. 2995.)*

Belgium.—December 1st. Belgian Ministry of National Defence, 10, Rue du Meridien, Brussels. 458 portable accumulator batteries of 150 amp.-hour capacity for the signalling section of the Army. Particulars (Cahier des Charges Special No. 709) for 4½ fr. from 15, Rue des Augustins, Brussels.

Brighton.—November 25th. Electricity Department. One 15,625-kW turbo-alternator, with condensing plant and auxiliaries. (See this issue.)

Bradford. — November 13th. Tramways Committee. Stores required during 12 months, commencing January 1st, 1927, including electrical fittings for tramcars (Sch. No. 3), insulated bolts and controller contacts (Sch. No. 7). Schedules and forms of tender from Mr. R. H. Wilkinson, general manager, 7, Hall Ings, Bradford.

Cardiff.—November 22nd. Electricity Department. One water-tube boiler, mechanical stokers, and forced-draught plant; steel chimney and grit-collecting plant; induced-draught plant. (October 29th.)

Croydon.—November 26th. Tramways Department. 10 complete bodies for electric tramcars, 10 sets of maximum traction bogie trucks, 10 sets of magnetic track and wheel-brake equipments, and 10 sets of electrical equipments, &c. (See this issue.)

Dublin.—November 8th. Dublin United Tramways Co. (1896), Ltd. Stores for 12 months, including electric lamps, electrical fittings, &c. (October 22nd.)

Egypt.—CAIRO.—Egyptian State Railways, Telegraphs and Telephones. Chief Inspecting Engineer in London, Queen Anne's Chambers, Broadway, Westminster, S.W.1. 1,500 3-way switchboard cords, 1,000 3-way plugs for switchboard.

December 5th. Ministry of the Interior. Electric motors and accessories. (B.X. 2996.)*

Guildford.—The Corporation is inviting tenders for the installation of electric motors and pumps at the sewage pumping station.

Hastings.—November 30th. Corporation. Two sets of electrically-driven turbine or centrifugal deepwell pumps, with all electrical equipments, &c. (See this issue.)

India.—December 21st. India Store Department. 280 miles (approx.) 110,000-V overhead transmission line. (October 29th.)

Kirkcaldy.—November 9th. District Committee. Electric lighting installation at 96 houses. Mr. G. B. Deas, architect, Central Chambers, Kirkcaldy.

Latvia.—November 20th. Post and Telegraph Administration. High-frequency telephone equipment. (B.X. 2993.)*

Leyton.—November 19th. Urban District Council. Installation of electric lighting and a central heating system at Knotts Green Special School. (October 29th.)

London.—PADDINGTON.—November 19th. Great Western Railway. Stores, including telegraph instruments, electrical apparatus, electrical wires and cables, &c. (October 22nd.)

Manchester.—November 19th. Electricity Department. Industrial electric motors, starting switches for d.c. motors and star-delta switch starters. (See this issue.)

New Zealand.—WELLINGTON.—December 7th. Public Works Department. Induction regulator. (B.X. 2935.)*
January 4th, 1927. Switchgear and transformers for the Waikaremoana electric power scheme. (B.X. 2872.)*
January 18th, 1927. Transmission line steel towers for Waikaremoana power scheme. (A.X. 3732.)*
February 1st, 1927. Storage battery and booster for Waikaremoana. (B.X. 2937.)*
December 15th. Government Railways. Switchgear, cable, motor-generator sets, junction boxes, &c., for the Hutt Valley locomotive workshops. (B.X. 2949.)*
Post and Telegraph Department. December 6th. Key switches. (B.X. 2962.)*
Public Works Department. February 15th, 1927. Transformers for Waikato. (B.X. 2985.)*

Plymouth.—November 16th. Electricity Department. C.i. pipes. (See this issue.)

Salford.—November 6th. Board of Guardians. Wiring, fittings, &c., for new mortuary and converted laundry buildings at Union Infirmary, Hope, Pendleton. Specifications from Mr. E. H. Inchley, clerk to Board of Guardians, Poor Law Offices, Eccles New Road.

Stoke-on-Trent.—November 10th. Electricity Department. E.h.p. switchgear for central power house, e.h.p. switchgear and moulded stone for Stoke sub-works, and neutral earth resistance for central power house. (October 15th.)
E.h.p. and l.p. totally-enclosed ironclad switchgear. Coal and ash-handling plant for the Central Power House, Hanley. (October 29th.)

Walton-on-the-Naze.—November 17th. Electricity Department. 2,300 yd. l.p. cable, joint boxes, compound and feeder pillars. (See this issue.)

Worthing.—November 23rd. Corporation. Fire-alarm system. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Chesterfield.—We mentioned in our issue of October 22nd the acceptance by the Council of a tender of Messrs. Reeve and Kenning, Ltd., for 14 trolley vehicle bodies at £6,337. We are informed that this is incorrect. The Town Council has given the contract for the complete conversion of the Corporation tramway system to railless traction to Messrs. Clough, Smith & Co., Ltd., this contract including the conversion of the overhead equipment and the supply of 14 of their Straker-Clough trolley omnibuses complete with bodies.

Darwen.—Town Council. Accepted:—
Electricity meters.—Landis & Gyr.

Dundee.—The Electricity Committee has accepted a foreign tender for cables, owing to the quoted prices being lower than those of British firms. We are informed that there was a difference of about £640 in favour of the foreign tender on a total of £3,454.

Faversham.—Education Committee. Accepted:—
Installing electric light at the Council schools.—Henry S. Tett & Co., Ltd.

Guildford.—Town Council. Accepted:—
Wiring 56 houses for electric light (£439), with extension to 114 additional houses, subject to the present contract being carried out to the satisfaction of the borough electrical engineer.—A. Grove

Ilford.—Electricity Committee. Accepted:—
Automatic time switch (£115).—Metropolitan-Vickers Electrical Co., Ltd.

Irish Free State.—DUBLIN.—The undermentioned contracts were placed by the Controller of Stores (Posts and Telegraphs) from August 29th to September 25th:—
Batteries and cells.—General Electric Co., Ltd.
Cables (various).—Dennis & Co.; Victor Zorn; F. Routledge; Bergmann Electric Light Co. (Ireland), Ltd.; Siemens-Schuckert (Ireland), Ltd.: Goerz Bros. & Kellie (Ireland), Ltd.; E. C. H. Handcock.
Compound (insulating).—Dussek Bros. & Co., Ltd.
Megger (bridge).—Evershed & Vignoles, Ltd.
Protectors (telephone).—Ericsson Telephones, Ltd.; Phœnix Telephone Co., Ltd.; Telephone Manufacturing Co., Ltd.—*Irish Electrician.*

Standard Telephones and Cables, Ltd., of London, has been commissioned by the Irish Post Office to supply a broadcasting station for Cork. It will be located in the gaol, now unrequired, and will be of a similar type to that now in operation at Birmingham, but of an approximate 3-kW Geneva rating.

Liverpool.—Health Committee. Accepted:—
Two complete sets of pneumatic crude sewage ejectors and electrically-driven air compressors (£892).—Adams Hydraulics, Ltd.

London.—MARYLEBONE.—Highways Committee.
Overhead electric runway crane at district wharves:—

Patterson Hughes, Ltd. (Recommended.)	**£2,375**
Morris, Ltd.	2,391
Jenkins & Co., Ltd.	3,080
Henderson & Co., Ltd.	3,239
Heywood & Co., Ltd.	3,942

BATTERSEA.—Electricity Committee. Recommended:—
Works power switchboard (£1,353); switchgear for 1,000-kW set and feeders (£1,552).—General Electric Co., Ltd.

Manchester.—Education Committee. Accepted:—
Rearrangement of electric lighting at Ashton Old Road school.—R. Seddon & Sons. At Municipal School of Art.—J. A. Somerset & Co.

Poplar.—Electricity Committee. Recommended:—
Erection of lift at power station (£1,216).—Waygood-Otis, Ltd.
Coal conveyor (£568).—Mitchell Conveyor Co., Ltd.

Portsmouth.—Electricity Committee.
7,800 yd. l.p. cable:

Johnson & Phillips, Ltd. (Recommended.)	**£1,723**

13,200 yd. three-core h.p. cable:

Johnson & Phillips, Ltd. (Recommended.)	**£12,045**
W. T. Henley's Telegraph Works Co., Ltd.	12,320
Callender's Cable & Construction Co., Ltd.	12,210
Siemens Bros. & Co., Ltd.	12,540

Salford.—At the meeting of the City Council last week, the Electricity Committee's recommendation to accept the tender of the N. V. Nederlandsche Kabelfabriek, of Delft, Holland, for 7,000 yd. of l.p. cable at £1,836 was rejected. It was stated that the lowest British tender was £2,397, a difference of about £561. Councillor Worthington, in moving the reference back, said he hoped the tender would be given to the local firm, notwithstanding the higher figure. The *Manchester Guardian* says that before a decision was taken the members of the Labour group left the Council Chamber in a body and the voting resulted in the tender of the local firm being accepted by 16 votes to 9.

Thurstonland.—Urban District Council. Accepted:—
Installing electric light in houses at Farnley Tyas.—Smith & Hargreaves.

Trowbridge.—Isolation Hospital Committee. Accepted:—
Installing electric lighting at the hospital.—Edwards & Armstrong.

Tynemouth.—Electricity Committee. Accepted:—
Cable (£188).—Macintosh Cable Co., Ltd.

Walthamstow. — Essex Education Committee. Accepted:—
Installing electric light at the Monoux Grammar School (£670).—Bailey and Ingledon.

West Hartlepool.—Corporation. Accepted:—
12 low-loading platform Straker-Clough trolley omnibuses.—Clough, Smith & Co., Ltd.

Forthcoming Events.

Institution of Fuel Economy Engineers.—Friday, November 5th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 6 p.m. Paper on "Pulverised Fuel Firing for Steam Boilers," by Mr. R. Jackson.

Institution of Mechanical Engineers.—Friday, November 5th. At the Institution, Storey's Gate, S.W. At 6 p.m. Thomas Hawksley Lecture on "Elasticity and Plasticity," by Prof. E. G. Coker.

Junior Institution of Engineers.—Friday, November 5th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Mast Erections," by Mr. C. H. Woodfield.
Friday, November 12th. Annual general meeting.

Electrical Power Engineers' Association (Southern Division).—Friday, November 5th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 7 p.m. Lecture on "Televisory Remote-Control Sub-Stations," by Mr. C. I. Shuttleworth.

Salford Technical and Engineering Association.—Saturday, November 6th. At the Royal Technical College. At 7 p.m. Paper on "Electric Motors and their Application," by Mr. W. Inglis.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, November 8th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "The Economics of Lamp Choice," to be opened by Mr. D. J. Bolton.

(Mersey and North Wales (Liverpool) Centre).—Monday, November 8th. At the University, Liverpool. At 7 p.m. Paper on "High-power Fusible Cut-outs," by Mr. L. C. Grant.

(Western Centre).—Monday, November 8th. At the Merchant Venturers' Technical College, Bristol. At 6 p.m. Address by the chairman, Mr. W. G. Heath.

(North-Eastern Centre).—Monday, November 8th. At Armstrong College, Newcastle-upon-Tyne. At 7 p.m. Papers on "The Applications of Machinery at the Coal Face," by Mr. S. Mavor; and on "The Design of Storage-Battery Locomotives for use in Coal Mines," by Mr. L. Miller.

(Scottish Centre).—Tuesday, November 9th. At the Royal Technical College, Glasgow. At 7.30 p.m. Address by the chairman, Mr. W. L. Winning.

(South-Midland Centre).—Wednesday, November 10th. At the University, Birmingham. At 7 p.m. Paper on "The Design of City Distribution Systems, and the Problem of Standardisation," by Messrs. J. R. Beard and T. G. N. Haldane.

(Dundee Sub-Centre).—Thursday, November 11th. At the University College, Dundee. At 7.30 p.m. Paper on "An All-Electric House," by Prof. S. P. Smith.

(Irish Centre) (Dublin).—Friday, November 12th. At Trinity College, Dublin. At 7.45 p.m. Paper on "Electro-Farming," by Mr. R. Borlase Matthews.

(London Students' Section).—Friday, November 5th. At the Institution, Victoria Embankment, W.C. At 6.15 p.m. Opening address by Mr. E. H. Shaughnessy on "The Rugby Radio Station."

Institute of Marine Engineers.—Tuesday, November 9th. At the Institute. At 6.30 p.m. "Some Notes on Reduction Gear," by Mr. W. J. Guthrie.

Association of Mining Electrical Engineers (London Branch).—Tuesday, November 9th. At the Junior Institution of Engineers. At 6.30 p.m. Presidential address by Mr. W. F. Bishop.

(North of England Branch).—Saturday, November 13th. At Neville Hall, Newcastle-on-Tyne. At 3 p.m. Paper on "Induction Motors," by Mr. A. B. MacLean.

Royal Society of Arts.—Wednesday, November 10th. At John Street, Adelphi, W.C. At 8 p.m. Inaugural address on "International Interests in Raw Materials," by Sir T. H. Holland, F.R.S.

Institute of Wireless Technology.—Wednesday, November 10th. At the Engineers' Club, Coventry Street, W. At 7 p.m. Paper on "High-Speed Automatic Transmission," by Mr. A. H. A. C. Cranmer.

Birmingham Electric Club.—Friday, November 12th. At the Grand Hotel, Birmingham. At 7 p.m. Paper on "Electric Tramways," by Mr. A. C. Baker.

Physical Society of London.—Friday, November 12th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary meeting.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

WEARN'S automatic drive.
OLMA adapters.
SEGAR electric grill.
Electrically-heated clothing presses.

Notes.

National Association of Supervising Electricians.—At the opening meeting of the new session of the Association, Mr. A. M. Sillar, M.Inst.C.E., delivered his presidential address, in the course of which he gave an interesting account of the early history of the electrical industry in this country. Mr. Sillar himself entered the electrical field in 1882, a year which he described as "the most critical period in the existence of the industry." Unfortunately "the company promoter and the get-rich-quick public" were in the field, and an electric lighting boom began which, in Mr. Sillar's opinion, did more harm than the Electric Lighting Act of 1882. Enormous profits were declared, arising not from business done, but from the sale of licences and concessions; in six months 68 companies were registered, with nominal capital aggregating over 20 millions, of which some 14 millions was actually subscribed. Very few of the shareholders got any of their money back, and many of the companies ceased to exist—though some survived, such as Callender's and Henley's, and the Edison and Swan companies.

Mr. Sillar gave many details of the working of the Jablochkoff company (with which he made his start) and other concerns. "The company promoting and wild speculation of 1882 were directly responsible for a setback to the industry, which hampered it for many years."

Mr. E. North, chairman of the Association, was in the chair. During the evening 21 certificates were presented to the winners in the N.A.S.E. Educational Competitions for the years 1923-25, by Mr. J. S. Highfield, M.Inst.C.E.

Faraday House Old Students' Association.—The annual dinner of the Association was held at the Hotel Cecil on October 29th, the president, Mr. L. J. Kettle, M.I.E.E., electrical engineer to the Dublin Corporation, being in the chair. The toast of "Faraday House and its Old Students" was proposed by Professor W. H. Eccles, F.R.S., president I.E.E. He pointed out that this country had considerable leeway to make up before its electrical development equalled that of its rivals. The uncertainty of the past year had held up hundreds of thousands of pounds' worth of electrical manufactures and delayed progress. The new Government schemes should open the way to a much greater use of applied electricity, and progress in that direction could only be made if a large supply of able and competent junior engineers, such as those turned out by Faraday House, was always available.

In reply, the Principal, Dr. Alexander Russell, F.R.S., referred to the good work done by Dr. Eccles in the lectures on radio communication, which he gave to successive generations of Faraday House students prior to the war; this work proved of the greatest value to those Faradians who were wireless officers during the war. He mentioned that the number of students at Faraday House was now 280, and that they had a record entry this term. During Mr. Kettle's year of office the membership of the "old students" had increased by nearly 20 per cent., and was now approaching 800. He then read out a list of the honours and distinctions gained by Old Faradians during the past year, and, in conclusion, thanked the affiliated companies for their helpful co-operation in training students.

Mr. G. Scott Ram, O.B.E., in an amusing speech, proposed the toast of "The Guests." This was responded to by Sir Philip Dawson, M.P., and Mr. R. A. Chattock. Sir Philip said he had no fear for the future of this country; given equal opportunities, he thought that the English engineer was at least as clever as any of his rivals. He spoke of the good work that was done by Faraday House in turning out men admirably qualified to help the engineering industries. Mr. Chattock said that Britain was *not* "down and out"; in spite of the difficulties of the times, the pluck and resource of British engineers enabled them to carry on.

Mr. W. Hewat, M.P., President of the Electricity Supply Association of Ireland, proposed the toast of "The Chairman," who was his colleague in many important undertakings. Mr. Kettle, in reply, said that in his opinion the prospects of electricity supply in Ireland were very bright, and that English manufacturers could reap a rich harvest there provided that their prices were no dearer than those of their foreign competitors.

An excellent musical programme concluded an enjoyable evening. There were over 200 members and guests present.

Exhibition of Inventions.—A few exhibits of electrical interest were to be seen this year at the International Exhibition of Inventions, which was held at the Central Hall, Westminster, from October 13th to 23rd. Some models of small-type electric cooking and food-warming apparatus were included. The Windsor Electric Range Co. showed a small portable oven, designed specially, it is claimed, for economical working. Top and bottom heating is provided by four separate element units; these are easily accessible. The cooking space is 13 in. by 12 in. by 10 in. Three-heat control is arranged for and the maximum loading is 650 W. A series of simple and useful food-warming appliances was shown by Messrs. Hotlock, Ltd., and included some models of hot cupboards equipped with ordinary gasfilled illumination lamps. The ovens are fitted with shelves and special containers. Some of these are provided with an alternative heating arrangement by means of a special odourless fuel. This is intended to serve those cases where the apparatus is required for use in both town and country houses wherein no supply of electricity is available. A circular model is claimed to be very effective on a very low consumption: a 40-W lamp is used to keep hot as many as four dishes, special containers being arranged vertically in the cylindrical casing. An attachment for bowl radiators which should prove useful for kettle boiling was shown by Miss A. R. Dow. This consists of a circular trough which fits over the upturned bowl of the radiator. A hole in the centre exposes the bottom of the kettle direct to the heat from the element, and any liquid spilt is caught in the well of the device. Wiremen should find a pipe-bending device exhibited by Mr. J. F. Carey of particular interest. This apparatus, the "Splitubenda," will fill a long-felt want on wiring jobs away from the workshop. It consists of a bend of steel troughing of a suitable size, according to that of the tubing to be worked, over which the latter is bent. Attachments at the end of the tool allow for it to be screwed to any piece of timber or to a door or other convenient article. The tubing is secured at the top end by means of a ring of a suitable size, both the tube and the end of the tool being inserted in the ring; the tube is then pressed over the troughing until the required bend is obtained. A demonstration proved conclusively that any bend required for ordinary wiring could be made. A special photo-printing paper, "Ozalid," was shown by the Ozalid Co., 91, New Oxford Street, W.C.1. This is intended to replace the usual drawing office blue prints. The paper is treated with ammonia fumes in a special apparatus, and no washing is required. Messrs. H.E.C. Electric Co., Ltd., showed a pedestal arc lamp for ultra-violet treatment. This is equipped with a Bowden carbon resetting device. A series of high-ratio gear-reducing units were also exhibited by this firm. These are designed for reductions up to 1,225 to 1. The principle is that of internal and external engagement. A novel radio crystal set, no larger than a threepenny piece, base dimension, was shown by Mr. H. L. Rosenthal.

Mr. A. J. Ashdown showed a new design of rotoscope which, by its shutter construction, gives, it is claimed, a glimpse period of 1/5,000 sec., and the correct speed rate per min. of any periodic motion up to 40,000 per min.

The Ball of the Batti-Wallahs.—The first Batti-Wallah ball will take place at the Westminster Palace Rooms on Monday, November 29th. Tickets may be obtained from members or the hon. secretary, Mr. M. Whitgift, 7, Coulter Road, W.6.

Meter Engineers' Technical Association.—A meeting was held on October 21st, when a paper on "The Testing of Large-Capacity Meters *in situ*" was read by Mr. W. Casson. An interesting discussion ensued. Owing to the length of the paper, it was found necessary to divide it into two parts; the second part will be read at the meeting to be held on January 21st, 1927. The first annual dinner will be held on January 22nd.

Appointments Vacant.—Senior electrical inspector of factories (£548) for the Home Office. Assistant lecturer in electrical engineering at the Government Technical Institute, Insein, Burma. Improver for the East Grinstead U.D.C. Electricity Department. Meter tester and reader for Holmnrth U.D.C. Electricity Department. (See our advertisement pages to-day.)

Scientific Street Lighting.—At the invitation of Messrs. Holophane, Ltd., a number of municipal electrical engineers met at the Hackney Borough Council's electricity showrooms on October 28th to witness a street lighting demonstration with Holophane prismatic glass reflectors. Mr. L. L. Robinson, borough electrical engineer of Hackney, took the party into the side streets, where gas lamps have been converted to electric lighting. The old gas standards and lanterns have been retained and time switches of the 30-day type have been installed, made by the Horstman Gear Co., and adapted to a special design by Mr. Bowden, of the Council Electricity Department. The lighting is by 250-V, 75-watt lamps on a 240-V circuit. Holophane prismatic refractors of the cylindrical band type are employed, which direct the light up and down the street between posts where dark zones were formerly. The refractors are supported by an adjustable slider and can be raised or lowered so that they may be adjusted to the best height to suit local conditions. The inner and outer surfaces of the refractors are smooth and can therefore be easily cleaned. Over 1,000 gas lamps are to be converted, and in order to maintain the efficiency of the street lighting, the Council has introduced a mobile lighting service. The motor cars are equipped with all the necessary materials for carrying out repairs, and "scouts" drive through the streets, detect any faults, and rectify them immediately. Messrs. Holophane, Ltd., manufacture three types of prismatic refractors for street lighting—two-way, three-way (which direct the light in the shape of a "T"), and four-way. At the conclusion of the demonstration the party was conveyed by car to Frascati's restaurant and entertained to dinner by the company.

A Wiring Competition (on Paper).—Mr. D. Smeaton Munro, M.I.E.E., informs us that he has asked the *Electrical Contractor* to publish particulars of a "wiring competition"; it is, in fact, the preparation of estimates for wiring the prize electric house illustrated in the E.D.A. booklet, "Electric Lighting in the Home." Mr. Munro offers a prize of seven guineas, which will be awarded to the competitor who places in the correct order (decided by the competitors' own votes) the various systems of wiring suitable for use in small houses. As all "tenders" are to be submitted by November 17th, those who propose to enter the competition must lose no time. The conditions are contained in the *Electrical Contractor*, for November, 15, Savoy Street, W.C.2.

Association of Mining Electrical Engineers.—WESTERN BRANCH.—Sir A. Whitten Brown, of the Metropolitan-Vickers Electrical Company, presiding at the first meeting of the season of the Western branch at Swansea, stated that electric winders had now proved themselves in South Wales, the Midlands, and the North, yet there was a recurrence of prejudice against them. What the reason was he did not know. Guarantees and figures of efficiency should never be regarded as a joke, as they formed a bond for the manufacturer. He went on to suggest frankness in all discussions so that remedies could be found for any defects in electrical mining.

American Cable Practice.—In our report of Mr. P. Dunsheath's lecture on his visit to the United States, headed "American Cable Practice," on page 683 of our issue of October 22nd, the reference occurs: "The cables are being made jointly by the General Electric Co., America, and Messrs. Pirelli-General." We are informed by Messrs. Pirelli, Ltd., that this statement is not correct, as the cables are made jointly by the General Electric Co., America, and the Pirelli Company, of Milan, Italy.

Institution Notes.

Institution of Electrical Engineers.—INFORMAL MEETINGS SECTION.—The first informal meeting of the session was held on Monday, October 25th, when the President, Dr. W. H. Eccles, F.R.S., took the chair and opened a discussion entitled: "Does Heavy-current or Light-current Electrical Engineering Afford the Greater Scope to a Young Man with Electrical Engineering Ability?" Dr. Eccles held that the light-current side offered better prospects for the skilled technician because so much of the research and design of heavy-current apparatus was nearing finality, whilst the light-current work was only beginning. As Dr. Eccles probably anticipated, this opinion was generally contested by the subsequent speakers. It was pointed out that the variety and types of switchgear and control gear had hardly begun to approximate to standardisation, nor could it be declared that electric plant and high-pressure cables were yet in their final states.

Institute of Transport.—We have received a copy of the report of the Council and statement of accounts of the above Institute for the year ended September 30th last. The total membership at that date was 2,487. The income for the period under review amounted to £4,585, being £1,306 in excess of the expenditure. The report recalls that during the year Messrs. W. Worby Beaumont and A. Paterson were appointed to serve on the Main Electrical Vehicle Committee of Great Britain.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

The Southwark Guardians have placed on record their appreciation of the services of Mr. D. M. KINGHORN, the borough electrical engineer, lent to them by the Borough Council, in connection with electric lighting and lift installation work (£8,500) at the Newington Institution and hospital. They propose to make a further payment of £100 for his services and those of his assistants.

According to the *South African Mining and Engineering Journal*, Mr. E. G. WEYHAUSEN, director of Messrs. Siemens (S.A.), Ltd., was leaving Cape Town in the middle of October for England and the Continent.

Mr. P. J. ROBINSON, who delivered his inaugural address as chairman of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers, at Liverpool, on October 25th, began his electrical career in the year 1895 with Messrs. Johnson & Phillips. After serving his time with them, he went to the Central Technical College at Finsbury and studied under the late Professor Silvanus P. Thompson. He next took up the position of chief assistant in the cable-testing department of the British Insulated & Helsby Cables, Ltd., at Prescot, and later was appointed engineer and manager to the Garston Electrical Supply Co. When the Garston area was absorbed, in the year 1902, by the Liverpool Corporation, the electricity supply concern was taken over by the Electric Supply Department of that Corporation. Mr. Robinson was first an assistant engineer there, subsequently taking the post of mains engineer in 1905, followed by the position of superintending engineer of stations in 1908, and that of chief engineering assistant in 1917, becoming in 1920 deputy city electrical engineer of Liverpool, which office he now occupies.

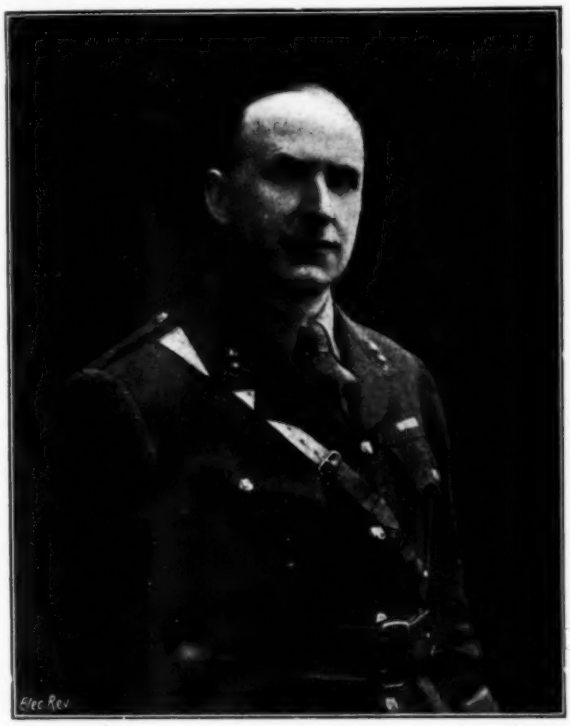
Mr. P. J. Robinson, M.I.E.E.,
Chairman of the Mersey and North Wales Centre, I.E.E.

Mr. J. W. J. TOWNLEY, who, as stated in our last issue, is recommended for the appointment of electrical engineer to the L.C.C. Tramways Department, went to Bradford, which he now leaves, in 1922, from Sunderland, where he had been chief assistant to the Corporation. His previous positions had been at Paisley, Manchester, Ashton, and Barnsley. Mr. Townley, whose portrait accompanies these notes, is a vice-chairman of the North-Midland Centre of the Institution of Electrical Engineers.

Walter Scott [*Bradford.*

Mr. J. W. J. Townley.

Colonel J. F. LISTER, C.M.G., T.D., M.I.E.E., the new chairman of the South Midland Centre of the Institution of Electrical Engineers, who delivered his address at Birmingham on October 20th, is a nephew of Sir Robert Ashton Lister, of Dursley, Gloucestershire. He was educated at Dean Close, Cheltenham, and in 1891 was articled as a pupil to the Bath Electric Light Co., Ltd. (now the Corporation Electricity Works), one of the first three central stations to be started in this country by that pioneer of electricity supply, Mr. H. G. Massingham. He left central station work to take up manufacturing, and gained his engineering training with Messrs. W. J. Lister & Sons, general and textile engineers, of Dursley. He started, as a subsidiary company of this concern, the Lister Electric Manufacturing Co., who made the "Lister" dynamos and motors, specialising particularly in a fully-enclosed type of motor. This business (now Mawdsleys, Ltd.) was bought by Messrs. R. A. Lister & Co., Ltd. After managing the company for a short period, Colonel Lister joined Messrs. Veritys, Ltd., of Birmingham, in 1903, to take charge of their engineering department. He is now vice-chairman of this very old and well-known company, and is also a director of Spencers (Melksham), Ltd., specialists in grain-handling and coal-conveying machinery. He has taken a great interest in Volunteering, and was one of the first 50 to join the Electrical Engineers, R.E. (Vols.) started by the late Dr. John Hopkinson. He



H. W. Barnett] *[London.*

Col. J. F. Lister, C.M.G., T.D., M.I.E.E.

commanded the Birmingham Detachment of this unit, and remained with it until the formation of the Territorial Army in 1908, when he was asked by the G.O.C., South Midland Division, to raise and command the Signal Units (Army Troops), consisting of Wireless, Cable, and Air Line Companies. This he did, and was gazetted lieut.-colonel the same year. There were five groups of Signal Units, *viz.*, London, Scottish, Western, Northern and Midland, which, after the outbreak of war, were grouped into a Signal Training Centre for the training and supply of all Signal *personnel* for the different war areas. During the last two years of the war Colonel Lister was acting A.A. and Q.M.G. to the Training Centre. He was promoted full Colonel and received the honour of C.M.G.

The Sydney City Council has lately been discussing proposals to advance the salaries of Mr. FORBES MACKAY, general manager, and Mr. S. Y. MALING, deputy general manager, of the electricity department, by £1,500 per annum each, making that of the former £3,500 and that of the latter £2,850. According to Press reports the subject is still under consideration.

Mr. ALBERT HUTCHISON, of the electrical staff of the Glasgow Corporation lighting department, has received an appointment under Mr. T. ROLES, M.I.E.E., city electrical engineer, Bradford, as public lighting inspector.

Mr. A. BROOKES, M.Eng., M.I.E.E., who has been appointed chairman of the East Midlands Sub-Centre of the Institution of Electrical Engineers for the present session, was a student in the faculty of engineering of the University of Liverpool from 1904 to 1907, taking the honours course in Electrical Engineering in his final year, graduating in the Bachelor degree in 1907 and being granted the Master degree in 1918 for special research. After Liverpool he took a post-graduate course at the University of London. After varying experiences, including electrical works, power station and marine engineering, Mr. Brookes entered the telephone branch of the industry, on the manufacturing side of which he has been engaged for 18 years at the Beeston factory of Ericsson Telephones, Ltd., as technical engineer and chief of the research laboratories. He is on the staff of the University College, Nottingham, where he has been evening class lecturer for many years, a member of the engineering advisory committee to the University Senate, and a member of the local board of management to the Notts. County Education Authorities. He is also a member of the British Engineering Standards Association, sitting on the B.E.S.A. Sectional Electrical Committee No. 22 and he is a member of Panel 22/11/1.

The John Fritz Medal for 1927 has been awarded to Mr. E. A. SPERRY, inventor of the gyroscope bearing his name.

Obituary.—SIR J. SZLUMPER.—Sir James Szlumper, who passed away on October 26th, at the age of 93 years, was a director of the Richmond (Surrey) Electric Light & Power Co., Ltd.

CAPTAIN A. W. SIRETT.—We regret to learn of the death, which occurred on October 23rd, at his residence at Preston, of Captain A. W. Sirett, R.E. (T.), A.M.I.E.E., executive engineer, Post Office Engineering Department, Preston, Lancashire (External Section). Captain Sirett joined the Post Office service as a telegraphist in 1884, transferring subsequently to the Engineering Department, where he was successively sectional engineer at Coventry, Gloucester, and Preston. He served for 23 years in the Volunteer and Territorial Forces. On the outbreak of the Great War he was commissioned in the R.E. Signal Service, being posted to the 2/1 Welsh Division at Carnarvon, and proceeded to France in 1916, where he was posted to the famous Anzac Corps, and served subsequently as second-in-command of "L" Signal Company R.E., at G.H.Q., on the lines of communication. The interment took place with military honours at Broughton Parish Church, near Preston, on October 27th, being attended by a numerous concourse of his brother officers and friends.

MR. W. E. PENDER.—The death occurred, on October 31st, at a nursing home at Blackheath, at the age of 66 years, of Mr. William Edmondstone Pender, O.B.E., late superintendent of the Eastern Telegraph Co., Ltd., at Cairo and Alexandria

LADY GAVEY.—We regret to read in *The Times* that Mary, widow of Sir John Gavey, C.B., passed away on October 31st, at Hampton Wick.

HERR O. ARKE.—The death is reported from Berlin of Herr Oskar Arke, one of the pioneers of the electric porcelain industry in Germany. From 1892 to 1912 he was head of the Hermsdorf Porcelain Factory at Hermsdorf, Thuringia.

New Companies Registered.

West Cornwall Electricity Supply Co., Ltd. (217,172).—Registered as a public company on October 29th with a nominal capital of £20,000 in £1 shares. The objects are to carry on in England or elsewhere the business of an electric light and power company in all its branches. The minimum cash subscription is 7 shares. The first directors, to number not less than 3 nor more than 6, are:—F. D. Tuckett, 17, Durham Villas, Kensington, W., barrister; H. T. Crosthwaite, Little Bowden, Pangbourne, Berks., stockbroker; E. Charrington, Ice Wood Cottage, Limpsfield, electrical engineer; H. B. Grotrian, K.C., M.P., "Knolls," Leighton Buzzard, barrister; F. E. Gripper, 14, Malbrook Road, Putney, electrical engineer. Qualification, £1. Remuneration as fixed by the company. Secretary: C. H. Jones, 67, Hayes Road, Bromley, Kent. Solicitors: Godfrey, Warr, Clarkson & Co., 85, Gracechurch Street, E.C.3. The registered office is at Broad Sanctuary Chambers, Westminster, S.W.1.

Natwirco, Ltd. (217,015).—Private company. Registered October 22nd. Capital, £100 in 1s. shares. Objects: To increase the popularity of wireless within the range of broadcasting areas by means of advertisement and otherwise, to act as radio and general engineers, &c. The first directors are:—H. N. Westgate (managing director), 74, High Road, Chiswick, W.4; A. Turner, 55, Lodge Road, Croydon. Qualification, 1 share. Registered office: 3, Pepys Road, Raynes Park, Surrey.

Work Meters, Ltd. (217,137).—Private company. Registered October 28th. Capital, £12,600 in 12,000 ordinary shares of £1 each and 12,000 deferred ordinary shares of 1s. each. Objects: To acquire from J. Denton, develop and turn to account certain inventions and patents and all his rights and interest therein, to adopt agreements (1) with J. Denton and (2) with Lewenz & Wilkinson, Ltd., of 25, Victoria Street, S.W., and to carry on the business of manufacturers and salesmen of work meters and other recording apparatus. The first directors are:—Capt. J. Denton, Riversdale, Long Preston, Yorks., dyer; W. C. Sutherland, 118, College Road, Bromley, Kent, engineer; H. I. Lewenz, 25, Victoria Street, S.W., engineer; E. R. Wynne, 25, Victoria Street, S.W., engineer (all permanent subject to each holding 100 ordinary or deferred ordinary shares). Remuneration (except managing director, if any), 5 per cent. of the net profits per annum after deduction of income tax, divided between them. Solicitors: Beardall & Co., 10, George Street, W.1, and E. H. Vant, 26, Park Row, Leeds, of Settle. Registered office: 25, Victoria Street, S.W.1.

Pressland Products, Ltd. (217,105).—Private company. Registered October 27th. Capital, £100 in £1 shares. Objects: To market, manufacture, produce, trade and deal in the articles, appliances and things covered by certain patents granted or to be granted to C. Pressland, and to carry on the business of electrical and motor engineers and contractors, suppliers of electricity, carriers of passengers and goods, manufacturers of and dealers in radio apparatus, &c. The subscribers ((each with one share) are:—C. Pressland, The Croft, London Road, Hampton, engineer; J. M. Hamilton, Willowbrook, Hampton Hill, secretary of golf club. The first directors are to be appointed by the subscribers. Qualification, 1 share. Solicitors: Bateman & Co., 5, John Street, Bedford Row, W.C.1. Registered office: Old Drill Hall, London Road, Hampton-on-Thames.

Eunice Wireless Cabinet Works, Ltd. (217,073).—Private company. Registered October 26th. Capital, £1,000 in £1 shares. Objects: To acquire the business of Isaac Cooklin now carried on by him at 16, McGrath Place, Hoxton Street, N., as the "Eunice Wireless Cabinet Works." The first directors are:—F. E. Ellis (managing director), Walter House, 418, Strand, W.C.2; I. Cooklin, 138, Brook Road, Stoke Newington, N.16. In the event of the death or retirement of the said F. E. Ellis, W. K. Webster shall have the sole right of nominating and appointing another director in his place. Qualification, £1. Solicitors: Leslie Williams and Alder, 9, Laurence Pountney Hill, E.C.4. Registered office: Walter House, 418, Strand, W.C.2.

Official Returns of Electrical Companies.

Wholesale Equipments, Ltd.—F. J. Alban, of 84, Queen Street, Cardiff, ceased to act as Receiver on October 13th, 1926, of the property and assets comprised in and charged by debenture dated December 31st, 1923.

Royce, Ltd. (63,871).—Capital, £170,000 in 70,000 preference and 100,000 ordinary shares of £1 each. Return dated July 16th, 1926. 34,955 preference and 72,487 ordinary shares taken up. £27,461 paid (being £1 per share on 4,955 preference and 6 ordinary and 1s. per share on 30,000 preference shares). £79,981 considered as paid (being £1 per share on 72,481 ordinary and 5s. per share on 30,000 preference shares). Mortgages and charges, £16,201.

Friend, Wintle & Co., Ltd.—F. J. Alban, of 84, Queen Street, Cardiff, ceased to act as Receiver on October 13th, 1926, of the property and assets comprised in and charged by a debenture dated June 29th, 1923.

Provincial Tramways Co., Ltd. (6,445). — Capital, £275,440 in 10,000 preference shares of £10 each and 175,440 ordinary shares of £1 each. Return dated June 1st, 1926. 10,000 preference and 124,560 ordinary shares taken up. £162,700 paid on 3,814 preference and 124,560 ordinary shares. £61,800 considered as paid on 6,186 preference shares. Mortgages and charges, £87,500.

R.M.P., Ltd.—Satisfaction in full on August 10th, 1926, of debentures dated September 17th, November 5th, November 27th, 1925, and July 8th, 1926, securing £100, £350, £307 and £300 respectively.

Gilfillan Bros., Ltd.—Debenture dated October 15th, 1926, to secure £750, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. Greenwood, 40, Hertford Avenue, East Sheen.

F. C. Thornley, Ltd.—Satisfaction in full on August 4th, of mortgage and debenture, both dated May 28th, 1926, securing £1,500.

City Wireless Co., Ltd.—Satisfaction to the extent of £200 on June 18th and to the extent of £500 (balance) on October 13th, 1926, of debenture dated March 24th, 1925, securing £700.

Debenture dated October 13th, 1926, to secure £500, charged on the company's undertaking and property, present and future, including unpaid capital. Holder: P. E. Beaver, 70, Edge Lane, Liverpool.

Brijane, Ltd.—F. T. Shearcroft, of 76, Newgate Street, E.C.1, was appointed receiver and manager on October 8th, 1926, under powers contained in first mortgage debenture dated June 12th, 1924.

W. Sisson & Co., Ltd. (82,295).—Capital, £50,000 in 5,000 preference, 38,000 ordinary, and 7,000 deferred shares of £1 each. Return dated August 3rd, 1926. 4,375 preference, 31,711 ordinary, and 7,000 deferred shares taken up. £28,686 paid on 4,375 preference and 24,311 ordinary shares. £14,400 considered as paid on 7,400 ordinary and 7,000 deferred shares. Mortgages and charges, £3,342 (due to Lloyd's Bank, Ltd., overdraft limit, £15,000).

International Electric Co., Ltd. (113,906).—Capital, £51,000 in 31,000 ordinary and 20,000 preference shares of £1 each. Return dated August 27th, 1926. 30,100 ordinary and 5,822 preference shares taken up. £32,922 paid on 27,100 ordinary and 5,822 preference shares. £3,000 considered as paid on 3,000 ordinary shares. Mortgages and charges, £70,500.

Torquay Tramways Co., Ltd.—Satisfaction to the extent of £1,400 on September 30th, 1926, of charge dated March 8th, 1911, securing £60,000.

Musselburgh and District Electric Light and Traction Co., Ltd.—Satisfaction to the extent of £1,400 on September 30th, 1926, of charges dated November 13th, 1905, and May 11th, 1909, securing £90,000.

Ferranti, Ltd. (87,318).—Capital, £300,000 in 100,000 6 per cent. preference, 100,000 7 per cent. second preference, and 100,000 ordinary shares of £1 each. Return dated October 14th, 1926. 71,166 6 per cent. preference, 75,000 7 per cent. second preference, and 60,000 ordinary shares taken up. £206,166 considered as paid. Mortgages and charges, £45,634.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Argentine Light and Power Co., Ltd.

Sir G. A. Touche, Bart. (chairman) presided at the annual meeting on October 29th, and, dealing with the Cordoba undertaking, said that the hydraulic works had been considerably strengthened. That would lead to a considerable economy in coal, which was costly. The sales of energy, and consequently the receipts, showed an increase. They had finally electrified the auxiliary horse tramway; that and other extensions amounted to 10 miles. The tramways showed a remarkable increase. In Santa Fé the amount of energy sold, including that used by the tramways, rose from 4,889,998 to 5,377,373 kWh, and the demand had caught up with the station's capacity. They had decided to erect a new h.p. station of at least 6,000 kW capacity. The Santa Fé tramways had also been extended. Omnibus competition had been met in both cities, but 'buses could not entirely supplant tramways, and their chief use would be as feeders to the tramways. During the first five months of the current year there had been a further satisfactory advance. The chairman then reviewed the accounts (*vide* ELECTRICAL REVIEW, October 22nd, p. 697), and in conclusion referred to the proposed changing of the company's title to "The Atlas Light and Power Co., Ltd." He said that negotiations were in progress which would enlarge the scope of the company's business, and they had selected a title which bore the same initials. The report and accounts were adopted and the change of name approved.

Drake and Gorham, Ltd.

Mr. B. M. Drake presided at the annual meeting on October 28th, and in presenting the report and accounts (*vide* our last issue, p. 727) said that the hope of better results after the reorganisation had been fulfilled. The firm was established 40 years ago, and since incorporation in 1901 the tangible assets had more than doubled. They were continuing their endeavours to promote a combined service of gas and electricity, and were assisting gas companies to obtain Special Orders in districts not already covered. Although they still did a large amount of domestic business, they were also constantly engaged in large industrial contracts. Not only did they put in motors, &c., for mills and works, they also supplied modern generating plant which could produce electricity at a lower price than that charged by most of the supply companies. Mr. Drake mentioned several important orders which the company had recently received, including the lighting of Lowther Castle and Blenheim Palace and other large country-house work, as well as contracts for banks and business houses. The report and accounts were adopted.

Montevideo Telephone Co., Ltd.

The annual meeting was held last week, Viscount St. Davids (chairman) presiding. In presenting the report and accounts the chairman said that after a period of adversity the company's position was improving. The income had been higher and they had been able to pay a higher dividend. After a visit to Montevideo he had come to the conclusion that the company's plant there was old-fashioned and should be improved; it could only be improved, however, if a new concession was granted. They had strong and influential representation in Montevideo, and although difficulties had been encountered he thought that there was a very fair chance of arranging for a new concession. Even if that were not obtained the company could still carry on and pay good dividends. If, on the other hand, they did get a new concession, they were sure that the new capital required could be obtained from the present shareholders. The company had a good reputation and he was confident of its position and future. The report and accounts were adopted.

International Light and Power Co., Ltd.

The income for the past year was £81,908, and after meeting debenture charges, &c., there was a balance of £39,626, to which was added £14,382 brought forward, making £54,008. Of this sum £2,500 is transferred to reserve, £4,813 is allocated to discount on debentures, and the preference dividend absorbs £17,906, leaving £28,789 to be carried forward. The report says that the subsidiaries in Mexico, Argentina, and Brazil have made progress, but in Caracas competition was felt. The Venezuelan subsidiary was adversely affected by drought in two consecutive years, and the use of steam plant has led to increased working costs. Extensions to the reserve plant are being carried out. Meeting, November 8th.

Bogota Telephone Co., Ltd.—Last week the company issued particulars of its constitution and objects for information only. It holds a concession for 50 years from January 1st, 1902, for a monopoly of the public telephone service in Bogota and certain taxation advantages. The number of subscribers has quadrupled in the past 11 years, and the company has a long waiting list. Its capital is £150,000 in £1 shares, of which 143,607 have been issued and are fully paid. The net profit for the last completed year was equivalent to about 13 per cent. on the capital, and a dividend of 12½ per cent. has been declared.

Burndept Wireless, Ltd.—It was announced this week that Messrs. Johnson & Phillips, Ltd., had agreed to lend the company £50,000 at 8 per cent., and as a consideration the directors have given Messrs. Johnson & Phillips an option at par for five years on the unissued preferred ordinary shares. It is proposed that during the currency of the debenture which the lenders will hold they shall be entitled to nominate three directors. This transaction relieves the present shareholders of the necessity of providing further capital, as had been proposed.

Ever Ready Co. (Great Britain), Ltd. — The directors have declared interim dividends for the half-year ended September 30th as follows:—At the rate of 10 per cent. per annum on the preference shares, and 10 per cent. actual on the ordinary shares (5 per cent. actual last year). The directors propose to increase the capital of the company by the offer of ordinary shares to the preference and ordinary shareholders in proportion to their holdings on advantageous terms. Full particulars are to be posted to the shareholders on November 18th.

Dumbarton Burgh and County Tramways Co., Ltd.—The report for the year to July 31st last records a deficit on working of £5,955. After crediting the balance brought forward and making part provision for debenture stock redemption, a debit balance of £5,995 is met from the reserve account. The result is attributed to continued severe motor-'bus competition. As the debenture interest and sinking fund instalments are in arrear a meeting of debenture holders has been called to consider the position.

Norwich Electric Tramways Co.—The report for the year ended June 30th last, which was presented at the annual meeting on October 29th, showed a net profit of £20,391 and a balance brought forward of £1,605, giving a total of £21,996. Of this amount £10,000 is transferred to reserve and after the payment of a dividend of 4 per cent. a balance of £1,436 is carried forward. Both the car-mileage and the number of passengers carried declined so far as the trams were concerned, but the motor-'bus traffic showed a large increase.

Western Union Telegraph Co.—The earnings report for the nine months ended September 30th last records a gross revenue of $102,045,928, as compared with $94,181,287 in the corresponding period of last year. The net income was $11,362,405, as against $11,645,594.

It was reported from New York last week that Messrs. Kuhn, Loeb & Co. had sold $25,000,000 of the company's 25-year five per cent. bonds at par and accrued interest.

Shropshire, Worcestershire, and Staffordshire Electric Power Co.—An extraordinary meeting has been called for November 16th for the purpose of considering resolutions providing for the increasing of the company's capital by the creation of 140,000 shares of £1 each to rank *pari passu* with the existing 360,000 "B" ordinary shares and to authorise the directors to issue these and the "B" shares remaining unissued upon such terms as they consider fit.

Erinoid, Ltd.—The net profit for 1925-26 was £30,335, a decrease of £18,412. The addition of £4,043 brought forward and dividend from the French Omnilith Co., made available £35,847. After paying a final dividend of 6 per cent. (making 10 per cent. as against 12½ per cent. in 1924-25) and transferring £5,000 to general reserve, £5,000 to taxation reserve, and £500 to staff fund, a balance of £6,042 is carried forward.

Brompton and Kensington Electricity Supply Co., Ltd.—Last week this company announced its proposals for the capitalisation of free reserves; it is the fifth company to do so. It is intended to capitalise £60,000 and distribute it in the form of £1 ordinary shares in the proportion of one new share for each five at present held.

Prospectus.—*Anglo-Portuguese Telephone Co., Ltd.*—On Tuesday last the company offered for subscription £300,000 of 7 per cent. first mortgage convertible debenture stock at par. The proceeds are to be employed for the repayment of loans and the further development of the company's business. The list was to be closed yesterday (Thursday) or before.

Burndept Wireless, Ltd.—The directors state that their attention has been drawn to a circular which may induce shareholders to dispose of their shares in ignorance of the present position. Important negotiations are in progress, and it is hoped to acquaint shareholders of the result at an early date.

Agar, Cross & Co., Ltd.—The directors have declared a final ordinary dividend of 6 per cent., making 11 per cent. for the year, together with a bonus of 5 per cent., all free of tax, out of an available balance of £341,709 for the past year. The reserve receives £115,000.

Reduction of Capital.—J. G. WHITE & CO., LTD., AND REDUCED.—A petition for the confirmation of the reduction of the capital of this company from £350,000 to £106,000 has been presented to the High Court, and will be heard in London on November 16th.

Stock Exchange Notice.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Bogota Telephone.—143,607 ordinary shares of £1 each, fully paid, Nos. 1 to 143,607 (ex dividend).

Bolckow, Vaughan & Co., Ltd.—The directors report a net loss of £13,815, although there was a gross profit of £124,507 against a loss of £37,886 in the preceding year. The deficit is met out of the general reserve.

Brush Electrical Engineering Co., Ltd.—The directors, as promised at the last annual meeting, have evolved a co-partnership scheme, and this will be presented to a meeting of the shareholders on Monday next, November 8th.

Coventry Chain Co., Ltd.—The directors propose a final dividend of 7 per cent. on the old ordinary shares, making 10 per cent. for the year, and one of 5¾ per cent. on the new ordinary shares, making 6¾ per cent. for the year.

River Plate Electricity Co., Ltd.—The directors have declared an interim dividend of 3 per cent. on the ordinary stock, as in 1925.

Meters, Ltd.—A dividend at the rate of 4 per cent. has been declared on the ordinary shares for the half-year ended September 30th last.

A. J. Stevens & Co. (1914), Ltd.—The directors again recommend a dividend of 12½ per cent., out of a net profit of £44,891, for 1925-26.

City of Buenos Ayres Tramways (1904), Ltd.—A dividend at the rate of 5 per cent. (1s. 3d. per share) has been declared for the quarter ended September 30th.

Stocks and Shares.

MONDAY EVENING.

THE market in London electricity supply shares is in a singular state of indecision. The Brompton and Kensington Company proposes to capitalise £60,000 from the reserve of £158,700, which figured in the balance sheet at the end of last year. The distribution will be one new share for every five ordinary shares held. Anticipation looked for one new to every four, and the announcement caused a drop from 32s. to 28s. 6d., a rally subsequently restoring the price to 31s. 3d.

The Metropolitan and the County of London are expected to publish their figures during the present week. South Londons are ⅛ down at 2 11/16ths. The shares have been a weak market for some time. City Lights and County ordinary are easier by way of precaution against possible disappointments in the matter of capital reserve announcements. London Electrics continue to harden. Several of the preference shares have recovered the dividends taken from the prices last week. Midland Counties new preference strengthened to 6d. premium bid. The new ordinary £1 shares, 12s. 6d. paid, of the Sevenoaks and District Electric Company are offered in the market at 9d. premium or a shade less, free of stamp duty. Bournemouth and Poole have been neglected, the price remaining at a few pence under 30s. Newcastle-on-Tyne Electric Supply shares are unaffected by the announcement that the company has secured 12,000 new customers this year.

Excitement in Marconis has been less marked than it was a week ago, and the price reacted to 16s. 3d. Canadians, after being 4s. 9d., declined to 4s. 4¼d. Some of the holders of Marconis took advantage of the "Beam boomlet" to clear their books in view of the forthcoming auditors' report, which is not expected to provide cheerful reading. A remarkable rise has taken place in Burndept Wireless preferred, which stood at half-a-crown, and were suddenly run up to seven or eight shillings. It is said that the company has secured the extra capital required, and that this money will enable advantage to be taken of business opportunities offering. Holders were approached some days ago with the proposal that they should exchange their shares for those in another company; the rise in Burndept preferred followed almost immediately afterwards.

Eastern Telegraph and the associated companies' stocks have been further depressed by fears of wireless competition in connection with the new developments. After being acutely weak, the prices rallied to some extent upon a saner sentiment setting in. The Eastern Telegraph and the Marconi Companies have entered into an agreement for the construction of a wireless station in Greece.

Telephone Manufacturing shares have been rising again, and are now up to 8s. 9d., which is 1s. 3d. higher than the price at which the latest offer of shares was made. The Anglo-Portuguese Telephone has issued £300,000 7 per cent. first mortgage convertible debenture stock at 100. The ordinary shares are quoted at 17s. A new introduction to the market at the end of last week was the ordinary share of the Bogota Telephone Company. The price started at about 29s. 6d. and, within a few minutes, it had risen to 32s. 3d. Automatic Telephones are firm at 57s. 6d.

River Plate Electricity ordinary at 210 is ex the interim dividend of £3 payable to-day, November 1st. The dividend is the same as that of a year ago before the capital had become increased by the capitalised bonus of 10 per cent. given last April to the proprietors. The Sidro Company has declared a dividend for the past financial year of 35.25 fr. on the ordinary and preference shares alike. These are of the nominal value of 250 fr. each, and the ordinary, in which there is a good deal of speculation, are quoted at 12. Brazilian Traction, ex the usual quarterly dividend of 1¼, have gained a trifle at 112. The preference, now 106, were ex dividend in the middle of September. Mexican Utility issues have weakened, the Light and Power preferred being 3 down at 82½, and the first bonds at 66½, showing a loss of 3½ points. The Lisbon Electric Tramways report points out that there are still two years', 1923 and 1924, arrears of dividend due on the preference shares, which received, last July, their full dividend for 1925 and a further amount on account of arrears. The price of the shares is 18s. 6d. The ordinary shares, which have received no return since May, 1916, are quoted around 8s. 3d. The International Light and Power announces, in its report for the year ended June 30th, 1926, an income of £81,900, an increase of £8,600 over that for the previous twelvemonth. The Company's 5 per cent. first mortgage debentures stand at 81; coupons are due on the first of January and July.

Home Railway stocks are better upon what is considered a cheerful prospect for early termination to the coal dispute. Metropolitan Consolidated has gained 10s. Underground Electric shares are slightly lower at 11s. 6d. British Electric Traction ordinary put on 1¼ at 141¼. London United Tramways debenture stock has dropped to 40½.

Shares in the cable construction and electrical equipment companies are easier. Telegraph Constructions shed 10s.; Brush, General Electrics, British Insulated, and a few others show declines. The engineering group is firm, on the coal hopes just mentioned. Rubber shares are uninteresting. The standard of production for the new quarter that starts to-day will be 80 per cent., instead of the 100 per cent. that was in force during the past three months.

One of the American cable companies displays, in its office near the Stock Exchange, a large poster announcing in bold letters:—

"Messages accepted for Mars. Delivery guaranteed."

Underneath the word "Mars," and in small type, is printed "Pennsylvania."

Share List of Electrical Companies.

	Nom. £	Dividend. 1924.	Dividend. 1925.	Price Nov. 2 1926.	Rise or fall.	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	1	14	14	59/6	—	4 14 2
Brompton Ordinary	1	10	10	1⅝	—	5 12 2
Charing Cross Ordinary	1	15	15	2⅝	—	6 6 4
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	49/6	—⅛	6 1 2
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/-	—	5 14 4
County of London	1	15	15	3⅛	—⅛	4 17 10
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	31/8	—	6 8 0
Kensington Ordinary	5	15	15	17	—	4 8 3
Lancs. Light and Power	1	7½	7½	24/-	—	6 5 0
London Electric	1	10	10	36/6	+6d	5 9 7
do. do. 6% Pref.	5	6	6	5⅝	—	5 11 7
Metropolitan	1	11	11	40/9	—	5 7 10
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	20/6	—	5 17 1
Newcastle-on-Tyne Ordinary	1	7	7	21/8	—	6 11 9
do. 5% Pref.	1	5	5	17/6	—	5 14 5
do. 7% Pref.	1	7	7	24/-	—	5 16 5
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/6xd	+6d.	5 6 8
St. James' and Pall Mall	5	17½	17½	18½	—	4 14 7
South London	1	15	15	2¹¹/₁₆	—⅛	5 11 8
South Metropolitan Pref.	1	7	7	1½	—	5 12 0
Urban Ordinary	1	4	7	1½	—	5 12 0
do. 6% Pref.	1	6	6	20/6xd	—	5 17 1
Westminster Ordinary	1	15	15	2⅛	—	7 5 5
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	27/-	—	5 18 6
Home Rails.						
Central London Ord. Assented	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	60½	+½	8 5 4
do. District	,,	8½	9½	54	—	6 9 8
Underground Electric	1/-	Nil	Nil	11/6	—	Nil
do. do. Income	Bonds	6	6	101	—	*5 18 10
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	102½	—	5 17 1
do. Def.	,,	1½	1½	24½	—	6 1 3
Automatic Telephone	1	3	10	2⅛	—	3 9 7
Chili Telephone	5	5	6	6¼	—	4 7 4
Cuba Sub. Ord.	10	5	5	7⅛	—	7 0 4
Eastern Extension	10	10	10	17⅞xd	—½	*5 12 8
Eastern Tel. Ord.	Stock	10	10	180	—	*5 11 1
Globe Tel. and T. Ord.	10	10	10	19	—¼	*5 5 3
do. do. Pref.	10	6	6	11⅛	—	5 7 10
Great Northern Tel.	10	22	20	27	—	7 8 2
Indo-European	25	8½	10	47½xd	+½	*5 5 10
Marconi	1	10	Nil	⅞	—⅛	... ...
Marconi-Marine	1	10	7½	14xd	+6d.	6 13 4
Oriental Telephone Ord.	1	12	12	47/6	+⅛	*5 1 3
United R. Plate Tel.	5	8	8	7½xd	—	*5 3 5
Western Telegraph	10	10	10	17⅞	+⅛	*5 17 8
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	8	—	9 3 4
do. do. 2nd Pref.	5	6	6	2¹³/₁₆	—	10 13 4
do. do. 5% Deb.	Stock	5	5	75	—	6 13 4
British Electric Traction Ord.	,,	7	8	141½	—1½	5 13 4
do. do. 6% Pref.	,,	6	6	110	—	5 9 1
Brazil Traction	160	4	5	112xd	+½	4 9 3
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	86½	—	5 15 7
do. do. Preferred	,,	96/-	126/9	114½	—	*5 11 6
do. do. Deferred	,,	129/5	8	141	+1	*5 10 9
do. do. Deb.	,,	4½	4½	77½	—	5 7 7
London & Sub. Trac. 5% Pref.	1	2½	Nil	6/-	—	Nil
London United Tram. Deb.	Stock	4	4	40½	—3	9 17 6
Mexico Trams, 5% Bonds	—	5	5	67½	—	7 8 2
Mexican Light Common	100	Nil	Nil	35½	—	Nil
do. Pref.	100	Nil	Nil	89½	—3	Nil
do. 1st Bonds	—	5	5	66½	—3½	7 10 5
Yorkshire (West Riding)	1	5	—	11/6	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	1	12	13	53/-	—9d.	4 18 1
British Aluminium Ord.	1	5	10	46/3	—	4 6 8
British Elec. Transformer Pref.	1	Nil	7	18/9	—	7 13 5
British Insulated Ord.	1	15	15	3⅛	—⅛	4 7 3
Brush Ord.	1	10	10	26/3	—9d.	7 12 4
Callenders	1	15	15	3⅛	—	4 10 9
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	12/-	—	... ...
Edison-Swan	4/-	10	10	12/9	—	3 2 7
do. 5% Deb.	Stock	5	5	86	—	5 16 8
Electric Construction	1	10	10	32/-	—	6 5 0
Enfield Cable Pref.	1	7½	7½	1¾	—	6 6 4
English Electric	1	5	Nil	14/-	—6d.	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 18 1
do. Ord.	1	5	7½	29/-	—1/-	5 3 5
Henley	1	16	20	4	—½	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1⅛	—	*4 14 1
Johnson & Phillips	1	10	17½	68/9	—	5 9 9
Met.-Vickers Ord.	1	8	8	23/9	—	6 14 9
do. Pref.	2	8	8	2⅝	—	6 14 9
Siemens Ord.	1	7½	7½	1⅞	—	5 4 4
Telegraph Construction	12	20	10	29½	—1	*4 1 4

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price Nov. 2nd.	Fortnight's inc. or dec
a Acid, Oxalic	per lb.	6¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£32	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£35	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4¼d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3¾d. to 3¾d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£107 to £112	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£264	£17 dec.
Grade II	,, ,,	£185	£11 dec.
Grade III	,, ,,	£98	£4 dec.
c Brass (rolled metal 9" to 12" basis)	per lb.	10¼d.	¼d. dec.
c ,, Tubes (solid drawn)	,,	1/0 to 1/0¼d.	...
c ,, Wire, basis	,,	10¼d.	...
c Copper Tubes (solid drawn)	,,	1/1	...
c ,, Bars (best selected)	per ton.	£92	...
c ,, Sheet	,,	£92	...
c ,, Rod	,,	£92	...
d ,, (Electrolytic) Bars	,,	£67	...
d ,, ,, Sheets	,,	£144 10s.	...
d ,, ,, Wire Rods	,,	£76 15s.	...
d ,, ,, H.C. Wire	per lb.	9¾d.	...
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
a German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	8/-	...
h India-rubber, Para fine	,,	1/7½	¾d. dec.
l Iron Pig (Cleveland No. 3)	per ton.	£2/6	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	,,	£31	20s. dec.
g Mercury	per bot.	£16 10s. to £16 15s.	...
e Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/0½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2½	...
p ,, ,, wire	,,	1/4	...
o Platinum	per oz.	£23	10s. dec.
d Silicium Bronze Wire	per lb.	11d.	...
r Steel, Magnet, in bars	,,	7¼d.	...
n Tin, Block (English)	per ton.	£295 5s. to £295 15s.	£17 15s. dec.
n ,, Wire, Nos. 1 to 16	per lb.	4/5	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

A Large Turbo-Alternator Set for Manchester.—What is claimed by the company to be the largest single-unit turbo-generator ever built in this country has been ordered from the Metropolitan-Vickers Electrical Co. Ltd., by the Manchester Corporation. It is to be installed at the Barton power station, and will bring the capacity of that station up to 119,000 kW. The turbine will be of two-cylinder design with duplex exhaust from the low-pressure cylinder. It will operate at 1,500 r.p.m. under the existing steam conditions of the station, *viz.*, 350 lb. per sq. in. gauge pressure, 700 deg. F. total temperature and 29 in. vacuum at the economic rating (32,800 kW). Provision will be made for multi-stage feed heating to a feed temperature of 300 deg. F. at the economic rating. The main alternator is the largest which has ever been ordered in this country, a single unit of 50,000-kVA capacity. The weight of this machine will be 161 tons. The rotor will be a single forging 31 ft. 6 in. in length, and weighing 61 tons. The alternator will be directly coupled to the turbine and will generate at 6,600 volts, 50 cycles. It will be ventilated on the Metropolitan-Vickers patent closed-circuit system, part of the air being supplied by fans mounted on the rotor and part by a separate motor-driven fan. An auxiliary alternator of 1,250-kVA capacity at 420 V for house service will be directly-coupled to the main alternator, together with two exciters, one for each machine, which will be mechanically built as a single unit. The present generating equipment of Barton power station includes three 25,000-kW Metropolitan-Vickers turbo-alternator sets. The new set will conform to the arrangement adopted in the existing sets in that the main alternator will be permanently connected to 33,000-V step-up transformers, with switching carried out on the h.p. side.

Radio Communication.

By Senatore GUGLIELMO MARCONI, G.C.V.O., D.Sc., LL.D., Hon.M.Inst.C.E., M.I.E.E.

The "James Forrest" Lecture delivered before the Institution of Civil Engineers.—(*Abstract.*)

RADIO communication has become a most important science and industry, but we are still far from being able to say that "wireless" is based on well-understood foundations, unless we refer to the arrangements used in the past, which have become more or less obsolete; speaking generally, radio engineers four or five years ago thought they knew much more about the subject than we think we know to-day. The logical application of laws and formulæ brought us to the necessity of employing, for long-distance transmission, such enormous and expensive aerial systems and such large amounts of power as to make the method so costly in capital expenditure and operation that only a very small margin of profit would remain when the system was worked in competition with modern cables and land-lines. However, the whole theory and practice of long-distance radio communication is undergoing a most radical and beneficial change, and the upsetting of so many pet theories is having the welcome result of increasing its efficiency and usefulness to an enormous extent, whilst at the same time opening up what may prove to be fertile fields for research.

Commercial long-distance wireless-telegraphy has been carried out until recently exclusively by employing wavelengths of from 8,000 to about 30,000 metres and several hundreds of kilowatts at the transmitting end. The cost of the largest stations of this type is of the order of £500,000 each, but, considering that their speed of transmission is not very high, their cost and running expenses, which necessarily include interest on capital outlay, depreciation, and power consumption, have been high. Ten years ago I began to consider the possible alternative which might be offered by the use of waves only a few metres in length, being aware that with these waves, and these waves only, would it be possible to project most of the radiation in a narrow "beam" in any desired direction, instead of allowing it all to spread in every direction. Mr. C. S. Franklin, of the Marconi Company, has since followed up the subject with great thoroughness, and average measurements showed that the intensity of the energy received when reflectors at both the transmitting and receiving stations were employed was 200 times that which could be received without reflectors, and that daylight absorption decreased very rapidly with the shortening of the wave below 92 metres. Calculation, confirmed by experiment, proved that the directional effect of a radio reflector is a function of its dimensions in relation to the wavelength employed; hence, the dimensions of the aerial and reflectors can be reduced proportionately to that of the wavelength, and, therefore, also the cost and space occupied.

In July, 1924, an agreement was entered into between the Post Office and the Company for the construction of stations on this system, and the first new service was opened to the public on October 24th.* The working of these "beam" stations has already had interesting results, some of which are, perhaps, novel. Atmospheric disturbances, or X's, have been very much less severe than in any other long-distance receivers of which we have ever had experience. Thunderstorms in the vicinity of the receiving station do not cause much interference, unless (and it seems to be a rare occurrence) they should be inside the angle of receptivity of the receiving reflector and not too far off. I feel confident that the disturbances usually known as "atmospherics," as apart from "fading," have ceased to exist as a serious hindrance to the working of high-speed radio between England and Canada. I fully realise that this is a bold statement, but I feel pretty confident I am right in making it.

Reflectors have the advantage of diminishing "fading," brought about partly by the great increase of the received-signal strength obtained, which thereby increases the margin of readability of the received signals. Fading appears to be worse with wavelengths between 200 and 1,000 metres, and it is a fact that it does, to a certain extent, still exist on the Bodmin-Canada circuit and, on certain occasions, has even cut off all communication between the two stations. Two such bad periods occurred on September 20th and October 14th; both periods coincided with the appearance of very large sun-spots and intense Aurora Borealis, and at the same time telegraph lines (especially in Canada) and cables were greatly interfered with. I, however, noticed that during these bad periods signals could be received across the Atlantic by using waves of the order of 15 metres in length, and also that the working of ordinary long-wave stations was not interfered with. Waves as short as 15 metres, or less, can be received across long distances better by daylight than during night-time, and we also know that very long waves are not affected by daylight on the North Atlantic track. The conclusion I come to is that during the days when sun-spots and Aurora Borealis were noticed conditions, due to ionisation of the atmosphere at a certain height resulting in a lowering of the ionised stratum (equivalent to what I might term "intensified daylight"), were prevalent.†

Another "fading" period of a few hours' duration, which a newspaper wrongly attributed to "atmospherics," occurred during the severe storm on October 25th. We have not yet been able to ascertain to what causes it may be attributable; it may even have been due to some insulation fault. It is, however, obvious that we cannot expect an entirely new system to be perfect from the very start.

Provision has been made for the use of two waves of different length at the "beam" stations, and a shorter wave will be tested and used during any exceptional conditions of the nature of those I have referred to whenever they appear to interfere with transmission on the 26-metre wave.

The ether is becoming very congested over a considerable range of wavelengths: if we assume the rule adopted by the Government Committee which has drafted the British proposals for the next International Radio Conference, we find that 3,700 wave-bands, or channels, will be practicable for the short waves (between 5 and 100 metres), but only 90 for the long waves (between 5,000 and 30,000 metres). Should narrower wave-bands be adopted, the proportional permissible number of short waves would bear the same proportion to the possible number of long waves, but, in addition to this very great advantage of the short waves, they have a further one due to the possibility of restricting a large proportion of their power within a narrow angle by means of the "beam" system, and also to the screening effect of the reflector at the receiving station, which, by reducing the possibilities of interference, tends still further to increase the number of separate services which can be worked by means of these waves.

Very high working speeds appear to be possible only if short waves are employed, whilst at the lower frequency of the long waves speeds of the same order are quite unattainable. There exists no theoretical reason why, with a frequency of 3,000,000 (100-metre wave), the possible speed should not be 200 times as great as that attainable with a frequency of 15,000, which is of the order of that of the main transmitter at the Rugby long-wave station. The high-power long-wave stations in this country which at present are carrying out a commercial wireless telegraph service to and from the United States are capable of transmitting and receiving each way, under normal conditions and at the same time, at an average speed of 20 words per minute for a daily average of 18 hours, but the "beam" stations have already proved capable of sending and receiving at the same time at an average speed of at least 100 words a minute for 18 hours per day, which represents at least five times the traffic which could be handled during the same time by the long-wave stations, although the latter employ at least 10 times the electrical power used by the short-wave stations. These figures suffice to show that the whole art and science of radio transmission is undergoing a most profound process of evolution.

Another interesting economic feature of long-distance services should not be overlooked: the capital cost of a cable increases in simple and direct proportion to its length, but with short-wave wireless it is possible to send messages to Australia with an even smaller amount of electrical energy than is necessary to send them to Canada and, therefore, at a probably lower cost, or, alternatively, with greater speed and efficiency. Why, if the short waves are capable of covering the greatest distances without employing the "beam" system, have I always insisted on using it at all the stations my company is establishing for Imperial and other important long-distance services? My reasons are that, in consequence of "fading" and interference, the signals obtained from such stations are not strong enough for high-speed commercial services such as are required in our scattered Empire.

The use of more power than 20 kW never appealed to me, as tests between England and Canada have shown a signal strength which Mr. Franklin estimates normally to be some 100 times greater than that obtainable with non-directional aerials utilising the same power. Since the increase of strength of the received signals rises in proportion to the square-root of the power of the transmitter, it would be necessary to use 200,000 kW with the ordinary all-round radiating and receiving stations to give the same average strength of signals at the receiving end.

Wireless waves are far too valuable to be continuously scattered in all directions, and the "beam" system is not by any means limited to telegraphy: I feel confident that it can place wireless-telephony on a much more practical basis than it is on at present, besides helping picture and facsimile

*See ELEC. REV., October 29th, 1926.

† Prof. Elihu Thomson, in the 1924 "James Forrest" lecture, stated his opinion that extensive Auroral display was coincident with the existence of exceptional areas of disturbance on the sun, and also referred to the probability under such circumstances of a decided elevation of charge, or potential, of the outer partially-conducting layer 50 or 60 miles above the earth's surface.

transmission, including "television" and even what is called "broadcasting."

The results obtained by amateurs by means of short waves do great credit to them, but I think it is sometimes dangerous to attach too much importance to all their observations, especially when they concern "negative results." Only the other day I read a statement by an eminent authority that, according to amateurs' observations, the daylight range of a 100-metre wave did not exceed 200 miles, and for a wave 50 metres long 100 miles. I have carried out tests on a 100-metre wave for months on end, and have never found its daylight range to be below 1,000 miles; with a 47-metre wave (which is close to 50 m.) we have never observed any skip-distance commencing at 100 miles, or at anything like so short a distance. It would be unfortunate if, in consequence of some reports, the theory of skip-distances should become unduly generalised and extended.

I wish to say, before concluding, how much the perfecting of the "beam" system owes to the skill of Mr. C. S. Franklin on the scientific and technical side, to Mr. R. N. Vyvyan, engineer-in-chief of the Marconi Co., on the engineering side, and to Mr. A. G. Mathieu for his special work on short-wave receivers.

Notes from Canada.

(By Our Own Canadian Correspondent.)

The Gatineau River, a tributary of the Ottawa River, in the province of Quebec, is the scene of great activity due to the large power developments in progress. The *Canadian Engineer* recently described the work going on there. Four suitable sites for power development are available; at two of them construction work is now going on, and at the other two it will be started in the near future. About 116 miles above the power sites a dam is being built to create a storage reservoir which will have a capacity of over 82,000 million cu. ft. of water with a surface of about 10 sq. miles. One of the two power houses at present under construction will contain five vertical 34,000-h.p. turbines operating under a head of 95 ft. and at the other there will be five vertical turbines of 24,000 h.p., each designed for a head of 65 ft. A rather unusual feature of these stations is the fact that two out of the five generators in each station will deliver 25-cycle current, while the other three will deliver 60-cycle current. The reason for this is that the four 25-cycle generators will be used to supply the Hydro-Electric Power Commission of Ontario which, as reported in these notes not long ago, has made a 30-year contract with the Gatineau Power Co. for the supply of about 260,000 h.p.

Paugan Falls, one of the other power sites not yet being developed, will be equipped to deliver 25-cycle current exclusively and all of the output will go to the Commission. It is apparently intended later on to interconnect, through frequency-changers, the great transmission systems of the Shawinigan Power Co. and the Hydro-Electric Power Commission of Ontario; thus the water powers of the Niagara, Saguenay, Gatineau, Ottawa and St. Maurice Rivers will be all delivering power into one vast interconnected transmission system covering many thousands of square miles of territory, the extreme length of which will probably be about 900 miles. It is likely, too, that the St. Lawrence River, from which the power available in the international section alone is about 1,600,000 h.p., will be feeding into the same network before many years have passed.

It is impossible to estimate how long it will be before the actual work of development of St. Lawrence River power will begin, but progress towards it is being made. The latest news is that the Water Power Commission of the State of New York has recently forwarded to the Hydro-Electric Power Commission of Ontario the full text of the decisions reached by the former body with reference to St. Lawrence River power development. The next move apparently is for the H.E.P.C. of Ontario to reply to this document. There are likely to be some differences to settle because, on the New York side of the river, a single-stage development—which would flood a very considerable area of land on the Canadian side—is favoured, while in Ontario a two-stage development, flooding much less land and enabling the capital expenditure to be spread over a longer period, is thought to be preferable.

Private interests are constantly endeavouring to obtain leases of large water powers in Eastern Canada with a view to developing them and exporting much of the energy to the United States. New York State and the New England States are very anxious to obtain large supplies of low-priced Canadian hydro-electric power, but the Dominion Government seems to be averse to the export of power. The two great provinces of Ontario and Quebec are, however, increasing their power requirements so rapidly that both are jealous of the water power rights they possess on the various rivers. The Ottawa River, being a "navigable stream," comes under the jurisdiction of the Dominion Government so far as navigation is concerned, but the development of power from its waters can only be carried out by permission of the Governments of the two Provinces between the confines of which the river flows, and since a total of some 750,000 h.p. can be obtained under proper development, the matter is one of some importance.

The Premiers of Ontario and Quebec have been in conference recently with regard to the development of power at Carillon Falls on the Ottawa River. It appears that the "National Hydro Company" holds the lease for this power site, where about 260,000 h.p. can be developed. It is reported that approval has been given to terms involving the delivery of 130,000 h.p. and the payment of a royalty of $10,000 per year, besides an annual water rental of 60 cents per h.p. to each province. The export of power to the United States is, apparently, forbidden. No contracts have yet been drawn up for the delivery of any fixed quantities of power to either province—these will be the subject of further negotiations. It is expected that the National Hydro Company will begin development work at an early date, and it is anticipated that delivery of power will be possible by 1928.

In spite of the fact that the recently made contract between the Gatineau Power Co. and the Hydro-Electric Power Commission of Ontario assures to the latter a supply of about 260,000 horse-power, and that, apparently, about another 130,000 is in view from the National Hydro Company as noted above, Mr. Ferguson, Premier of Ontario, is reported to have said that the Government's policy with regard to the St. Lawrence River would not be influenced, as every effort would be made to further this policy, which is to have development work started as soon as possible.

The latest news regarding the diversion of water from Lake Michigan by the Sanitary District of Chicago—a matter which affects the possible development of power on the Niagara and St. Lawrence Rivers to the extent of 500,000 h.p.—is that the United States Supreme Court has granted permission to the State of New York to join the State of Michigan in its campaign against the Sanitary District. This will no doubt greatly strengthen the hands of the many States which are opposed to the diversion of some 10,000 cu. ft. of water from the waters of Lake Michigan to the Mississippi River.

Norwich Electricity Undertaking.

On October 28th the new generating station of the Norwich Corporation was officially opened by Alderman G. J. B. Duff, M.C., J.P., D.L., chairman of the Electricity Committee. The station is designed for an ultimate capacity of 50,000 kW, but at present constitutes a building to accommodate 25,000 kW. Two 5,000-kW turbo-generators have been installed, and a third and similar machine is to be transferred from the Duke Street station, the capacity limit of which has been reached. We hope to describe the new station fully in a later issue. At a luncheon which followed the inauguration ceremony, the Rt. Hon. the Lord Mayor of Norwich, Mr. Thomas Glover, C.B.E., said the time had come when the electricity and gas interests of the country should work harmoniously side by side.

Alderman Duff, in reply to the toast of the "Electricity Undertaking," said that the increase of the undertaking's output from 2¼ million kWh in 1904 to 21 million kWh this year had been steady and not spasmodic. The average price per kWh sold in 1904 was 3.59d., and was now 1.8d. Ten years ago the power output was twice as much as the domestic output; at the present time the two supplies were equal. One-half the houses in Norwich were at present lighted by electricity. Since this time last year 2,500 consumers had been added to the system. The Committee had adopted the policy of utilising the profits of the undertaking for its development, and not for the relief of rates. It had decided not to increase the charges for electricity, due to the high coal costs, until, at the earliest, January 1st, 1927. He advocated the building of houses with an eye to the installation of electricity for all purposes when the convenient time came. Breakdowns at the Duke Street station, which had been seriously overloaded during the past two years, had only been avoided by the diligence of the staff.

Mr. J. H. Rider, M.Inst.C.E., consulting engineer for the new station, paid a high tribute to the contractors and others employed on the erection of the plant at the new works. During last winter, due to constructional difficulties on the building, the machinery was at times covered with ice and snow. The original estimate for the machinery at present installed, excluding the fourth boiler and the telpher extension, was £19,000; the whole of the work would be covered by that figure.

Mr. F. M. Long, M.I.E.E., city electrical engineer, traced the growth of the generating plant from the three originally installed 100-kW sets to the turbines of the new station. The Committee had always been ready to scrap plant in favour of more efficient equipment. The present charges for electricity to the average Norwich dwelling were a fixed rate of about 30s. per annum, plus 1d. per kWh, so that the consumer was supplied with light for about £2 per annum. In addition the consumer could hire the installation at a rental of only 10s. per year. The undertaking was prepared to meet the requirements of the Norfolk farmers.

"The Contractors," by the Sheriff of Norwich, was replied to by Mr. J. P. Gregory, M.I.E.E., for the British Thomson-Houston Co., Ltd., and Mr. H. J. S. Mackay for the Stirling Boiler Co., Ltd. Mr. R. W. L. Phillips, president, I.M.E.A., and Alderman W. G. Knights, chairman of the Great Yarmouth Electricity Committee, replied to "The Visitors," proposed by the Deputy-Mayor of Norwich, Dr. G. Stevens.

The Economics of Lamp Choice.

The Sensitive Dependence of Rating and Economy upon Voltage.

By D. J. BOLTON, B.Sc.(Eng.), A.M.I.E.E.

(Abstract of paper published in the I.E.E. Journal.)

WHEN dealing with any equipment a greater first cost of which would result in decreased running costs, the size of such apparatus can be determined in either of two ways, physical or economic. That is to say, the size may be the minimum required to perform the given service without risk of breakdown, or it may be that size which will give a minimum total cost over a number of years of service. With most apparatus it is the former which receives chief consideration, but with lamps the economic criteria are always the determining factor; physical limits, such as the burning out of the filament, are never reached and the efficiency normally quoted is merely that which the lamp will attain when so run as to have a certain average length of life. This point is fixed by the lamp makers, usually such that the lamps will have an average life of about 1,000 hours, but, strictly, it should vary according to situation; for, if energy is expensive, it will pay the consumer to over-run his lamps and get a shorter life at a higher efficiency, and *vice versa*.

Lamps differ in two important respects from most other electrical apparatus: In the first place, the life is reckoned in hours of burning rather than in hours of actual existence, *i.e.*, the lamp is presumed not to depreciate except with use, and (barring mechanical vibration, or long periods of idleness) this assumption is probably sufficiently accurate for the purpose. In the second place, lamp renewals are relatively so frequent that the interest charges can be neglected in comparison with the depreciation charges.* Thus the economic calculations in connection with illumination are made on a basis of a service unit, *e.g.*, lumen-hours, whereas most other economic comparisons are made on the basis of a time unit, *e.g.*, annual cost, or total capitalised cost.

The problem is considered under two headings: (i) Choice of type (usually between two or three alternatives) and (ii) choice of rating, *i.e.*, voltage, and therefore of efficiency (over a range of alternatives). Following an example of the former, the latter is first treated graphically and approximately and the more general case is then worked out by algebraic means.

In considering the conclusions to be drawn from the formula, it should be noted in the first place that of the three variables, the lamp prices vary least, the lamp sizes vary more, whilst the energy prices vary most. With regard to lamp size and price, the larger or the less expensive the lamp, the more it should be over-run and the shorter should be the life aimed at. Thus, taking as a starting point the 40-watt lamp costing 2s., which is economical on its present-day rating with energy at 4d. a unit, it is evident that with this energy price any lamp of which the size in watts divided by the price in shillings exceeds 20 should be over-run. With a 60-watt lamp costing 2s. 3d., the best life will be 882 hours. On the other hand, with a 20-watt lamp costing, say, 2s. 6d., the most economical life (with energy at 4d.) will be 2,230 hours. If the lamp price were proportional to the size in watts, these items would cancel out, but unfortunately the price varies little (and sometimes inversely) with the size, and it would certainly appear that manufacturers should attempt to rate their lamps accordingly, even though they take no account of variations in the price of energy.

The third variable, *viz.*, cost of energy, is chiefly a problem for the consumer; but even here the manufacturers could help by grading their lamps for dear, medium, and cheap energy, somewhat on the lines of the "three-voltage rating" suggested some years ago in competing with the carbon lamp for cheap energy.

The B.E.S.A. specification permits deviations in efficiency of about 6 per cent. on either side of the specified normal, and, when these variations occur, the consumer (on specially cheap or dear circuits) could be given the opportunity of choosing them in place of the normal lamps. If no such help is forthcoming for the lamp user he must needs act for himself; the difficulty of so doing is that, whilst a considerable range of voltage ratings is available, the number of sizes is very limited and re-rating by voltage alone alters the size of the illumination unit. Thus, if the circuit voltage is 110 and lamps of about the 40-watt size are desired, the normal flux from such a lamp is 370 lumens. Assuming that 2s. is the price of the lamp, whatever the size or rating, calculation shows that with energy at 1d a unit the most economical rating is that corresponding to 91.7 per cent. of the normal voltage, or about 73 per cent. of the normal candle-power. This can be exactly effected by fitting 120-volt lamps, but if, say, the 60-watt size is chosen, the lamp flux will be 415 lumens instead of 370.

Taking as the other extreme energy at 8d. a unit, calculation shows an economic rating of 104.4 per cent. of the normal voltage. This requires lamps designed for a pressure of about 105 volts, and a 30-watt lamp of this type will then give 320 lumens when run on 110 volts. Such small changes in the size of the illumination unit are not necessarily disadvantageous, since there is no special virtue in the particular candle-powers associated with 30, 40 and 60 watts, and in any given case some intermediate values may be as good or better. It should be realised, however, that any such change will modify the economic calculation, since this is based on the assumption that lamps are available giving the original candle-power at the new rating.

So far, only initial conditions have been considered. It is difficult to determine exactly what effect deterioration should have upon the economic calculation; however, in comparison with the wide range of the other variables entering into the problem, its effect on the economic position will be slight, and its chief result is a lowering of the mean size of the illumination unit. When several energy prices rule (as when the first portion of the consumption is charged for at a higher rate) the economic choice should not be affected, since a change in efficiency will not affect the time distribution of the consumption.

Qualitative effects have been ignored throughout, but on a very cheap energy circuit it might pay to under-run lamps to such a point as to make the light too red for satisfactory illumination. Other limits to under-running when energy is very cheap would be vibration (causing the lamp to break before its calculated life period) and interest on capital. The latter could not safely be neglected if excessive under running (and long life) were proposed, or if the service were highly intermittent. Its cost could be brought into the problem if the annual hours of service were fixed and known.

The purpose of the paper has been not so much to arrive at any novel results as to emphasise facts not generally realised and to suggest possible courses of action by the manufacturer or the lamp user. The vital connection between rating and economy, and their sensitive dependence upon pressure, are at last being recognised, and Mr. C. W. Sully, speaking at the World Power Conference on behalf of the Electric Lamp Manufacturers' Association of Great Britain, said: "It is therefore extremely important that lamps should be operated at their rated voltage. . . . It is equally necessary that supply voltages should be as definite and constant as possible, in order that lamp manufacturers may rate their lamps at the most economical efficiency," but the problem is regarded too statically, and of the many recent attempts at educating the public in the proper use of lamps there has hardly been one pointing out that the correct rating is not something fixed by nature, or the lamp manufacturers, but should depend on circumstances and, in particular, upon the energy price and the lamp size. To cite a particular case, until recently the author was paying 7d. a unit for all his lighting energy whilst blocks of flats near by were buying their energy at a uniform price of 1d. Lamps which were economical for the one circuit would be quite unsuitable for the other, yet the same shop served them both, and there was nothing on the lamps or their wrappers to show that they were not suitable for the same voltage under all possible circumstances. In a similar way, 20-watt and 60-watt lamps for the same circuit should be designed to have quite different lengths of life.

The energy price is admittedly the most difficult item in the problem, and the above suggestions make no pretence of exhausting the possibilities. There can be no denying the importance of the problem, in view of the fact that the energy cost may frequently represent 90 per cent. or more of the total cost of the illumination, and that the energy price may vary as much as from 1d. to 8d. a unit. In the absence of any more positive action or assistance for the consumer, it would appear that the least that could be done would be to stamp on the lamp, or wrapper, the particular energy price as well as the voltage for which the rating was determined.

* A lamp burning for 3 hours at night and which lasts 1,000 hours has to be renewed approximately once a year. With interest at 5 per cent., the interest charge would be 1/20th of the depreciation or renewal charge, and can therefore be neglected in comparison.

Electricity on Board Ship.—The Fairfield-built Bibby passenger liner *Shropshire*, due to sail on her maiden voyage this month, has steam and electric heating throughout. On deck there are 12 electric winches. One of the motor lifeboats is provided with Marconi wireless equipment, embodying a separate power unit, which renders the employment of batteries unnecessary and makes the wireless equipment independent of the propelling plant. In the engine room are installed two Fairfield-Sulzer engines, each developing about 3,850 b.h.p. at 110 r.p.m. The scavenging air is delivered from two turbo-blowers, which are electrically operated, of the British Thomson-Houston type. The electrical generating plant is on a large scale, comprising three 275-kW dynamos, driven by Allen-B. and W. Diesel engines. An emergency dynamo, coupled to an oil engine, is utilised for supplying power for lighting at night in harbour and for the wireless telegraph installation. The latter is of the Marconi type and incorporates two transmitters, one being a 1½-kW quenched-spark set with a normal range of 800 miles, and the other a 1½-kW continuous-wave valve transmitter for working over distances up to 2,000 miles.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

The "Sunshine" Vacuum Cleaner.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2, has recently made a number of improvements in the design of its "Sunshine" vacuum cleaner (fig. 1). These are aimed at facilitating control and operation. The foot control switch has been dispensed with and has been replaced by a quick-make-and-break switch fitted to the handle. The dust container is made of very strong material which obviates any possibility of leakage. It has been found that a shorter handle is more convenient for floor cleaning and the length of the handle has therefore been reduced. The attachments supplied with the "Sunshine" cleaner include a medium-sized nozzle fitted with a double-bristle brush. The company supplies a very lucid pamphlet upon the use and care of the cleaner with each one sold.

New "Ediswan" Fires.

Another company which has produced several new patterns of fires for the season is the Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, E.C.4. One of the most striking of these is the "Reflectaglow" fire illustrated in fig. 2. This is the four-bar (3-kW) model; a smaller fire with three bars (2.25 kW) is also made. The elements are fitted in the front of a framework, the sides of which are perforated to facilitate the passage of the heat. At the top of the case a piece of amber-tinted glass is fitted and beneath it is a 60-W "Royal Ediswan" lamp, which sends its rays through the glass on to the curved repoussé polished copper reflector. The construction is light and the fire is produced in three finishes, *viz.*, oxidised brass, copper, and silver.

Fig. 1.—The "Sunshine" Vacuum Cleaner.

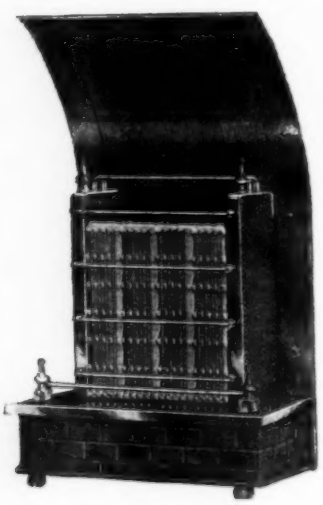


Fig. 2. -The "Reflectaglow" Fire.

Falk, Stadelmann Fires.

Several new designs of electric fires have been brought out by Messrs. Falk, Stadelmann & Co., Ltd., 83-93, Farringdon Road, E.C.1. Two of them are illustrated herewith. Fig. 4 is representative of the company's cheaper patterns for local heating only. It has been produced as an alternative to the company's bowl fire. The loading is 660 W and the fire weighs only 4 lb. 9 oz. Four finishes—black, brown, green and blue are provided.

The other fire (fig. 5) is a more expensive one and is of the imitation coal type. The front and frame are executed in fine-grain castings carefully dressed and polished, and the reflector is of burnished heavy-gauge copper. The elements (2.5 kW) are at the foot of the reflector and are of the plug-in type, making for easy replacement.

A New Dispersive Reflector.

With a view to facilitating the wiring of dispersive electric-lamp reflectors, the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2, has produced a new reflector, fig. 3, of this type fitted with a specially designed top. This is operated with one screw only and can be detached in a few seconds, and the holder is so arranged that it need not be unscrewed for wiring. The top, with the holder attached, can be screwed on to the conduit: the leads are guided through the bridge into the terminals, and the screws tightened home. The reflector element is then attached in a few seconds. This new apparatus is made in diameters of 12, 14, 16, 18 and 20 in., and is designed for use with "Osram" gasfilled lamps. Another advantage claimed for this reflector is a reduction in the time necessary for cleaning, and it is suggested that one clean reflector should be kept in reserve, so that when cleaning an installation each dirty reflector can be replaced in turn by a clean one being brought down the ladder for cleaning, thus reducing the risk of accidents and the necessary machine stoppages. The removable top clamps to a cast ring provided with ventilating slots. This ring is itself removable and is held in position by three screws on the inside, allowing the reflector to nest when packing is necessary, and thereby reducing freightage charges.

Fig. 3.—A G.E.C. Dipersive Deflector.

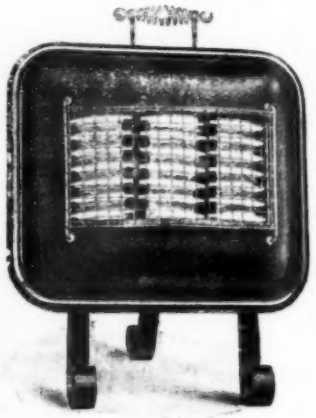


Fig. 4.—A Falk, Stadelmann Fire.

Fig. 5.—The "Efescoal" Fire.

A Special Transformer.

Messrs. T. M. Colquhoun & Company, 37, Canning Street, Glasgow, S.E., have just delivered to Messrs. Drysdale & Co., Ltd., Glasgow, a 3-phase transformer, embodying some special features. It is arranged to give an output of 500 kVA at 50 cycles, and 250 kVA at 25 cycles. A variable operating pressure of from 2,000 to 4,000 V is to be obtained from the secondary winding, with a maximum primary voltage of 800. Tappings are provided to give seven intermediate secondary pressures. They are arranged with special connectors, and can be readily altered to give the desired voltage on either periodicity. The transformer is for use on Messrs. Drysdale's test bed for testing directly-coupled pumping sets.

An Improved Switch.

A recent production of the Edison Swan Electric Co., Ltd., Ponders End, Middlesex, is a new pattern of ironclad switch, fig. 6, which is designed, it is claimed, according to the H.O. and I.E.E. Regulations for 15-A loading at 250 V. It has a

rapid and smooth positive quick-make-and-break action, with a minimum number of working parts. The break is under the influence of a main spring, but in the event of this failing it is possible to operate the switch in either direction and still obtain a quick break through the medium of an auxiliary spring. The switch blades cannot be left in any position between "on" and "off." The cover and operating lever are interlocked so that it is impossible to close the switch until the cover is closed, or to open the cover until the switch is "off." The contacts are sunk and mounted in a well-shielded porcelain base which provides high dividing walls between the individual contacts, between the contacts and the

Fig. 6.—A Double-Spring Switch.

case, and between the opposite poles. The wiring is arranged with the leads run directly through the wall of the porcelain base, avoiding the necessity to pass through intervening bushes in the iron case. The construction is robust and simple; the case and lid are made of clean and well-finished grey-iron castings, and the operating lever of malleable cast-iron. The contacts and blades are made from high-conductivity copper.

New Designs for E.L. Fittings.

Fig. 7 shows one of a new range of electric light fittings which has been recently brought out by MESSRS. JOHN LAWTON AND SONS, LTD., 30-33, Harford Street, Birmingham. It is designed particularly for commercial use and is supported by a diamond-pattern brass chain from a brass ceiling plate. The

Fig. 7.—Commercial E.L. Fitting.

totally-enclosed bowl element is a one-piece 3-ply glass unit. Other designs include various metal-work fittings treated with a special washable white coating, a three-light electrolier for which, it is claimed, particular attention has been given to the accessibility of the wiring, and various artistically designed fittings.

An Improved Cord Absorber.

We have received from MESSRS. STURGE & BAKER, LTD., Premier Works, Sheepcote Street, Birmingham, a new design of electric lamp flexible-cord absorber. This is of the old spring-controlled roller pattern with the addition of a ratchet device which arrests the absorber in any desired position, quite independently of the weight of the shade. The stop action is similar to that used on roller blinds; a slow movement of the reel causes the pawl to fall into the recess, but a rapid movement makes it jump the gap.

Electricity Supply in Liverpool.

By P. J. ROBINSON.

Abstract of Chairman's Address: MERSEY AND NORTH WALES (LIVERPOOL) CENTRE, I.E.E.

DURING recent years the load increase on the Liverpool generating stations has been abnormal, due to the steady increase in our own districts, and to the fact that we have absorbed the electricity supply of some of the neighbouring authorities. The output increased from 86,333,510 kWh in 1920, to 172,044,686 in 1925, and the maximum peak load rose from 38,317 to 73,614 kW. It therefore became necessary in 1922 to think of further extensions of our generating plant, and the following main alternatives were considered: The erection of a new station adjacent to a colliery; the extension of the existing station; and the erection of a new station on a river-side site. A station adjacent to a colliery would necessarily be of the cooling-tower type, and, so far as the steam consumption is concerned, would be at the best only equal in efficiency to the extension of the existing station, and less efficient than a station on a riverside site. Additional charges on the station would be a complete new generating staff, and the cost of h.p. transmission and the consequent losses. As these additional costs were estimated to exceed considerably the probable saving of 1s. 3d. per ton in the cost of coal, it was decided to rule out the colliery-site proposition, and to concentrate upon the choice between the other proposals.

It would appear on first consideration absurd to put down a cooling-tower station in a city like Liverpool, which possesses such a river as the Mersey, but it was found that the cost of land at the only site suitable and available for a riverside station was extremely high, and, in addition, there was another serious aspect to consider, namely, the difficulties of utilising the river water for condensing purposes. The extreme high- and low-tide levels in the Mersey differ by approximately 33 ft., and the estimated cost of civil-engineering work proved to be very great, as the station would either have to stand right out in the river, or, alternatively, two culverts about 600 ft. long would have to be constructed under the river bed to open at a point below the lowest tide level. In either case an expenditure of about £400,000 would certainly be entailed for the site and civil work before the actual station buildings were commenced.

Experience has shown that the loss of vacuum consequent upon the fouling of condenser tubes with silt and other *débris* is such that the increased efficiency may be reduced to about 8 per cent., or possibly lower. In addition, the problem of condenser-tube corrosion causes much more expense in the case of riverside stations, and it was found from tests that the amount of sand in suspension in the Mersey water for a period of 4 or 5 hours every day is as much as 15 per cent. of the total weight, an amount which would cause considerable erosion of the tubes and ferrules, and whilst the fouling of the tubes could be considerably reduced by the adoption of settling chambers, the first cost of these must be offset against the saving obtained, and is not included in the figure already given for civil work.

In order to assess the comparative values of the alternative propositions, a calculation was made on the following lines:—A uniform increase in load of 4,000 kW per annum was assumed, and the cost of the plant required for the next 5, 10, 15, 20, and 25 years was estimated. It was found that at the end of 15 years the total capital expenditure on the site at Lister Drive would be £1,291,000, with an average annual capital charge of £110,600 over the period, as against a capital expenditure on a riverside site of £1,649,000, with an average annual charge of £130,800; the capital charge per kWh on a 30 per cent. load factor at Lister Drive would be 0.168d., compared with 0.199d. at the riverside site. With the same load factor the average generating and capital costs over the period of 15 years for the additional load carried by the new station worked out at .69d. for the riverside station, against .67d. for Lister Drive, the higher cost of the riverside station being due to the increase in coal freightage, wages, station and transmission capital charges, and transmission losses, but against this the coal consumption should be lower by some 8 per cent. at the river site, as compared with the Lister Drive site. The result would be an excess of £441,900, £29,460 per year, at the riverside site, over the Lister Drive site. In view of these figures it was decided to extend on the existing site; this had sufficient space for a further effective 100,000 kW, and a large proportion of the present superintending staff was available. The station was laid out for five units of 25,000 kW rating each, the engine room being so designed that at some future date machines up to 40,000 kW could be installed (ELECTRICAL REVIEW, August 6th, 1926, p. 211).

To avoid the use of cables for the alternator connections the machine breakers are placed on the same centre lines as the alternators, and the connections are treated as bus-bars, bare copper being used in a chamber which forms part of the enclosed ventilating system of each alternator.

The boiler house contains six units, each capable of evaporating 60,000 lb. of steam per hour, at a pressure of 285 lb., and a total temperature of 700 deg. F. To overcome the difficulty in safety-valve operation on h.p. steam we have installed a 2-in. pilot valve on each boiler, a shut-off valve, normally open and locked, being fitted between this and the boiler. The pilot valve is set to blow off at about 10 lb. per sq. in. below the blow-off pressure of the main safety valve,

so that under ordinary circumstances blowing off and seat scoring takes place only on the pilot valve. Very high combustion chambers are embodied in the design of the boilers, the height from the surface of the grate to the underside of the tubes, in the case of the Babcock & Wilcox boilers, being approximately 14 ft. This feature has already been found to increase the efficiency and capacity of the boilers, and, at the same time, to practically eliminate the nesting of birds on the tubes. Oil-burning equipment has been installed in addition to the usual coal-firing apparatus. The combined use of coal and oil at times of peak load, will, of course, necessitate the handling by the forced and induced fans of greatly augmented quantities of gases.

The switch house has six floors, arranged as follows:—Basement, accommodating the main cable way and the pumping and cooling plant for the 33,000-V step-up transformers; ground floor, the step-up transformers, isolating switches for outgoing feeders, and the works sub-station; first floor, the incoming and outgoing isolating switches, oil circuit breakers, and instrument transformers; second floor, the bus-bar chambers, isolating switches, reactances, and control wiring chamber; the third floor serves as a distributing centre for all control cables which have come through the control wire chamber; and the fourth floor is the control room.

The works lighting is supplied by a station transformer, but in case of failure it is automatically thrown over to a station battery, to which some of the lighting is permanently connected.

The whole of the h.p. gear is enclosed in brick and steel cubicles, and to enable the rapid survey of the interior, reinforced glass windows have been provided in the sheet-steel doors; a lamp placed in each of the cubicles is controlled by a switch on the outside of the door.

A further novel feature is the alternator control arrangement. All the operating control equipment, as distinct from the instrument control, has been separated from the control panels and placed on a pillar in front of the main instrument panels carrying the control equipment for the main circuit breakers, earth circuit breaker, governor and exciter. In front of each pillar stands a Chadburn electric telegraph, which indicates the signal on a corresponding telegraph at the turbo-alternator, and also indicates in the boiler house the change of load conditions.

Derby Electricity Supply.

Opening of the Extensions.

Alderman W. G. Wilkins (chairman of the Electricity Committee) presided at the luncheon given after the inspection and opening of the extensions which are described on pp. 744-7 of this issue.

Lt.-Col. J. T. C. Moore-Brabazon, M.P. (Parliamentary Secretary to the Ministry of Transport), proposing the toast of "The Electricity Committee of the County Borough of Derby," remarked that Derby had one of the first plants designed from the start for the use of powdered fuel; and he would like to know from the experts how long it was going to be before they changed wholly from the burning of the country's coal, in its raw state, to the burning of what he described as "filleted coal." The oil bill from foreign countries was becoming exceedingly large, and they had to pay it every year; the sooner they used the vast mineral resources of this country for the benefit of the whole nation the better it would be. Referring to the Electricity Bill, he said they must look upon the distribution and the generation of electricity as two separate problems. He had had it impressed upon him how essential it was that smaller towns should take power in bulk. In the Bill they came to the generators of electricity, and proposed to them that they also should take power in bulk; that was the shock of their lives. In the past generating had been looked upon as a local need, but it was now a national need.

Alderman Wilkins was presented with a handsome oak-framed illuminated address, expressing the appreciation of his colleagues for his valuable services to the borough, for 30 years as a member of the Electricity Committee and 13 as chairman. In his reply he said he had cherished for years a desire that his native town should give a lead to the others in the use of powdered fuel for steam generation. Every piece of moving machinery started under previous chairmen 13 years ago had been ruthlessly scrapped; there was not a piece of obsolete plant on the premises. No words of his could express adequately what they felt at the passing from their midst of their beloved chief engineer.

Mr. J. A. Aiton, of Derby, proposed the health of Mr. T. P. Wilmshurst, the borough electrical engineer, who had recently been appointed as one of the Electricity Commissioners, and the Mayor presented Mr. Wilmshurst with a tea service of Crown Derby china on behalf of the Corporation.

Replying, Mr. Wilmshurst thanked the Council, and said that during his 28 years he had never had a cross word with any member of the Corporation. After paying a tribute to the chairman, the Electricity Committee, and the members of the staff, he said he had been very much touched by the letters he had received from engineers and friends all over the country congratulating him on his appointment. He was fully conscious, in succeeding such a man as Mr. Pearce, of his own limitations. When the scheme was published, there would be criticism, but he begged that it should be helpful and constructive.

Thanks were expressed by Councillor E. G. Morley (vice-chairman of the Electricity Committee) to the various contractors for the manner in which they had carried out the work. Mr. H. I. Brackenbury, of Messrs. C. A. Parsons and Co., Ltd., and Mr. G. C. Usher, of the International Combustion, Ltd., responded.

Mr. A. M. Jacob, M.A., chief engineer, South African Electricity Commissioners, congratulated Derby upon installing one of the most up-to-date plants in the country.

Wakefield Corporation Electricity Works.

Starting a New Set.

On Wednesday last week, at the Wakefield Corporation's power station, Calder Vale, the new 7,500-kW turbo-alternator set, which has been installed by the English Electric Company, Ltd., was formally set in operation by Ald. W. Emmett, chairman of the Electricity Committee, in the presence of an interested gathering.

At a dinner which followed, the Mayor (Ald. C. Mellor) presided, and Ald. H. Womersley (chairman of the Finance Committee) proposed "The City of Wakefield Electricity Undertaking." He said the policy of the undertaking had been one of steady expansion to anticipate the needs of the city, and to give an adequate and reliable supply for all purposes. Everything was being done to encourage and popularise the domestic use of electricity. During the past six months, in spite of the shortage of fuel supplies, there had been no limitation whatever, and no increase in price until the present time. The number of consumers had increased steadily since the commencement of the undertaking, but there had been an increase of nearly 100 per cent. in a little over three years. The site selected for the electricity works had an abundant supply of water and was in close proximity to coal, railway, and canal services.

Ald. Emmett, having touched briefly on the history of the undertaking, said they were in an admirable position for supplying electricity at the cheapest possible rate. He thanked the staff and workmen, and particularly their engineer, Mr. Fraser, for the admirable way in which they had worked to ensure the success of the undertaking.

Ald. G. H. Sherwood proposed "The Electricity Committee and the Staff," and spoke of the loyal service rendered by the staff at the electricity works, and by the men who did the manual work.

The toast was replied to by Mr. H. G. Fraser (city electrical engineer), who said the committee and the staff understood one another perfectly, and got on together very well.

The toast of "The Guests" was proposed by Alderman Foster in a humorous speech, and was responded to by Mr. T. Roles, city electrical engineer, Bradford, who acknowledged the pleasure the guests had derived from their visit to the power station. Speaking of the Electricity Bill, Mr. Roles said that so far as Bradford was concerned, the Council was of the opinion that any legislation that took place in connection with electricity should be on the basis that the generation, transmission, and control, should be in the hands of duly elected public representatives of the districts in which that electricity was to be supplied. That was practically the opinion of all the municipalities in the district. He saw that Wakefield had a turbine which had been built by the English Electric Company. Twelve years ago a turbine built by that company was put down at his own station; during the past twelve months that machine had developed nearly fifteen million units, or nearly fifty per cent. of the total electricity generated in Bradford during that time. He thought the Government had acted wisely in appointing Mr. Wilmshurst, of Derby, as an Electricity Commissioner; that gentleman would at least be able to sympathise with the owners of small undertakings.

Boiler Explosion Report.—We have received a copy of the Report of Preliminary Inquiry into the explosion of a stop valve at the Barking generating station of the County of London Electric Supply Co., Ltd., which occurred in December last, when two workmen were severely injured. The governor relay valve cover was violently forced off the chest, breaking all the studs, and was broken from its cast-iron superstructure, oil pipes, &c., and lifted over the turbine, damaging the floor plates and joists. Investigations indicate that shock, due to water hammer, was the probable cause of the explosion. The power station had just been shut down over a week end in severe weather, the conditions being favourable for the condensation of steam and lodgment of water. The makers of the valve have now adopted an alloy steel for the cover studs and reduced the diameter of the body to a size not exceeding that at the bottom of the thread, in order to prevent the localisation of strains. A drain has also been fitted over the relay valve and the drainage system has been modified.

The Institution of Electrical Engineers.

Inaugural Address by Dr. W. H. ECCLES, President.—*(Abstract.)*

(Concluded from page 738).

The farmer ought to be a large consumer of electricity. Electric light is as welcome on a farm as anywhere, and the electric drive is applicable to about a hundred agricultural machines. In addition, there are processes that require accurate rates of heating, various forms of electroculture, various ingenious ways of influencing the yield of eggs and milk, and applications to the bacteria of the dairy. In Germany more than 90 per cent. of the farms have an electric supply, and in 1925 their consumption totalled 1,030 million kWh, the maximum load being 400,000 kW; Swiss farms consumed nearly 400 million kWh in 1925; in France the State is giving financial assistance towards universal electrification of agriculture; in Japan there is great electrical activity, especially in the tea industry; in America 700,000 farms have an electric supply, but the consumption is only 30 million kWh per annum—scarcely justifying the outlay of £250 per mile on transmission lines, which, by the way, is about half the cost of similar lines in Britain. In our own country only 400 farms, that is, 0.08 per cent. of our half-million farms, are supplied with electricity, and their consumption is insignificant. Compared with America our distances are small, and therefore there is no physical difficulty in opening up a large market for electric power.

Finally we come to the domestic use of electricity. Its amount varies greatly from one country to another. In Switzerland, where coal is dear and hydroelectric power cheap, 90 per cent. of the dwelling houses are electrified; in Great Britain, where coal is cheap, only 18 per cent. are electrified. In Tokio 70 per cent. of the houses are lighted electrically; in Amsterdam 88 per cent. In Glasgow and Manchester less than 10 per cent. of the houses are wired, the majority using coal-gas. But in some British cities the domestic consumption of electricity is increasing rapidly; for example, in Leeds it is increasing by 27 per cent. per annum. Actually, the annual domestic consumption in Britain is, according to Mr. Woodhouse, only 10 kWh per head per annum where it ought to be 40 to 60. Probably this is partly due to our efficient coal-gas service. But illumination is a very large proportion of our domestic electrical load, which is unfortunate because a lighting load has a low load factor compared with a heating and cooking load. American experience on this point has demonstrated that the heating and cooking load in a city may become more important to a supply authority than the industrial load. For every reason, therefore, we all hope that the campaign of the Electrical Development Association and the Electric Lamp Manufacturers' Association will meet with the success it deserves.

In order to examine our national position in respect of electro-communication engineering, I take in turn internal and external communications. Inland, Great Britain is one of the most highly developed telegraphic countries. The number of telegrams per head of population and the number of words per mile of line place Great Britain very high in the list.

The number of telephones per hundred of population in various countries indicate that our people are not great telephone users. A better test of telephone utilisation is the number of conversations per head per annum; while the average American talks 191 times per annum, the average Englishman talks only 23 times. Our telephone population is increasing at the rate of 10 per cent. per annum.

Under the heading of line telegraphy must be placed that form known as the carrier method, in which a.c. of audio or radio frequency is used. The a.c. may be, and usually is, imposed upon existing telegraph and telephone lines. Germany has recently proved that six distinct frequencies below 4,000 per second may be simultaneously transmitted through telephone cable circuits without interfering with telephone subscribers, and on each channel speeds of nearly 200 words per minute can be transmitted. In America, Australia and this country, frequencies of 10,000 to 40,000 are regularly used. Here there are eight carrier current circuits working regularly, and in America there are many more—but complete statistics of such circuits are not yet available. It is sufficient to note that our engineers are prepared to apply this method on a large number of existing circuits if the increase of traffic should demand it.

External communications comprise submarine cables and wireless circuits; and these will be considered in turn. About £25,000,000 of British capital is invested in cables, and a revenue of about £10,000,000 per annum is collected; therefore cable telegraphy is one of our most important electrical industries.

In the field of wireless communication there are several branches to be surveyed. Long-range radiotelegraphic stations are tabulated in Table E from data kindly supplied by the Wireless Telegraph Board and the Wireless Section of the Post Office Engineering Department. When the beam stations are tabulated in Table E, from data kindly supplied by the long-range wireless communication as any other political unit.

Short-range land stations are very numerous in the principal countries, many of them being devoted to communication with ships.

TABLE E.

	Long waves.		Short waves.	
	Class I.	Class II.	Class I.	Class II.
United States	15	18	2	4
British Empire	5	18	8*	9
France	9	5	—	4
Italy	4	1	1	3
Russia	3	6	—	2
Germany	2	2	1	3

* Beam stations approaching completion.

This survey of our relative standing in the electrical world must include a reference to the home and export markets in electrical machinery and apparatus. The home market has, of course, shared in the general depression of the basic industries. The export market, on the other hand, has shown remarkable and encouraging features. In most cases the value of the post-war annual exports exceeds the pre-war exports.

British electrical exports now represent 25 per cent. of the total turnover of the industry, perhaps too large a proportion. Since 1924 about 12,000 miles of loaded submarine cable have been ordered, all of which has been, or is being, manufactured in England, except a length for connecting Emden to the Azores, which is being made in Germany.

Turning to the imports of electrical goods, we find that the imports of heavy electrical machinery are 30 per cent. less than before the war, and that the imports of power cables, chiefly non-rubber types, have increased 50 per cent. There has been an increase of 115 per cent. in imports of lamps, and of 610 per cent. in imports of batteries. Our wireless imports amount to £788,000, which is 61 per cent. of the value of the exports. Some of these increases are uncomfortably high, and the largeness of the wireless imports is disappointing.

In heavy electrical machinery exporting, the order of importance of the three principal nations in 1913 was Germany, Britain, America; in 1925 it was Britain, America, Germany.

In the new wireless industry America leads easily and Britain is last. It is disappointing to learn that out of £6,000,000 worth of wireless goods imported by Australia during the past 3½ years, British apparatus represented only £700,000, and the rest was mostly American.

Another disappointing item is the position of the British electrical instrument industry. In 1925 our exports were £366,000, and imports £270,000. The exports of German electrical instruments amounted to £1,556,000, and the imports were very small.

One of the most useful tests of the health of the scientific industries of a country is afforded by the statistics of its patent office. In 1925 about 49,000 patents were granted in America, 16,000 in Germany, and about 15,000 in Great Britain and Northern Ireland. Englishmen are, at the present epoch, making many fewer electrical inventions than is expected of them. We are, on the whole, importing more inventions than we originate—in other words, the improvement of our manufactures and the founding of new industries here, so far as they are based upon invention, is dependent largely on brain work done abroad. In addition, we export fewer inventions than the other leading nations do. Either we must spend money on technical education and research at home or, as an alternative, we must pay other nations to do the necessary brain work for us. This choice cannot be evaded. Inaction is not a loophole. By doing nothing we should merely find that some of our scientific industries would become out of date relative to the leading nations. The instrument industry appears to have recognised the urgency of its own needs and has supported its research association handsomely; if the cable industry and the heavy electrical industry were to organise similarly liberal support for other corresponding research associations, for instance, by a levy on turnover, the adverse trade balance shown by the patent office would probably be remedied in due course, and we might again export British inventions.

The remedies indicated in the preceding paragraph are fundamental, and will consume a decade or more in application; but we require at this moment immediate remedies for our immediate needs as disclosed by my analysis. Of these immediate needs, that of cheapening the supply of power to the basic industries of the country is the most pressing. To effect this cheapening we must turn Britain into a single power zone. Failing that we shall lose pride of place as a manufacturing country.

We, as electrical engineers, desire to help forward the electrical modernisation of our own country in any manner that may be decided upon by the nation generally; and we believe that if electrification is pursued steadily and tactfully, it can be accomplished without causing hardship or injustice.

The "AnchorA" Transmission-Line Pole.

A Method of Strengthening an "A"-type Pole's Foundation.

Anything which tends to reduce the capital charges involved in the electrical transmission of power should claim the attention of engineers. Accordingly, what is described as a new type of overhead-line wood pole, for which letters patent (No. 224,732) have been granted to Electrical Improvements, Ltd., will be of general interest. It is another of those seemingly obvious inventions which have not been thought of before.

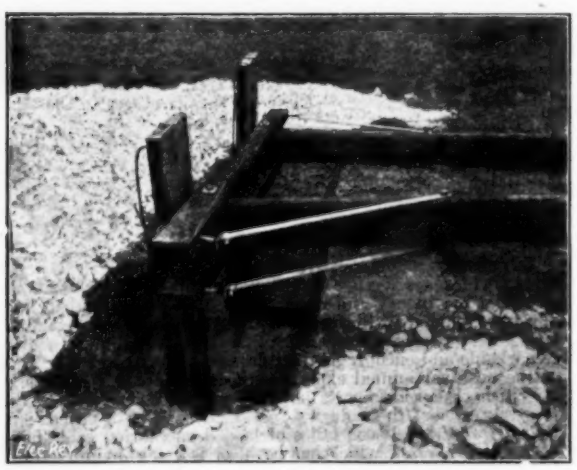


Fig. 1.—Foundation Base of Pole.

The patented pole is of the well-known "A" type, the improvement taking the form of strengthening its foundation. Thus, it is claimed to be more strongly "anchored" than is the ordinary type of "A" pole, and the appropriate name of "AnchorA" has been given to it. The utilisation of the full available strength of the "A" and "H" types of wooden pole is restricted by the relative weakness of their foundation. When the expense of setting them in concrete has been undertaken, such poles have proved to be highly efficient structures, but as ordinarily set with the usual earth footing, it is possible for failure to occur at a fraction of the load at which it would occur if the pole were set in concrete. The "AnchorA" foundation is, however, said to be as efficient as concrete setting without the added expense; anyhow, it is thought to afford sufficient strength to more than meet the needs of the maximum spans which are controlled by other factors, such as sag, &c.

Comparative estimates for a typical 20,000-volt, 3-phase line of 0.1 sq. in. section show that with the ordinary "A" pole it would be most economical to use 36-ft. poles and space them 180 ft. apart, while the new method of construction would allow of the use of 40-ft. poles spaced 400 ft. apart. The difference between the costs of the two types of line shows a saving in favour of the "AnchorA" construction of about 20 per cent. of the total cost of the line. Apart from the saving in first cost, moreover, the fewer supports required for a given length of line constructed in the improved manner should make its use particularly attractive in the country where transport is difficult and wayleaves are expensive and not easily obtained.

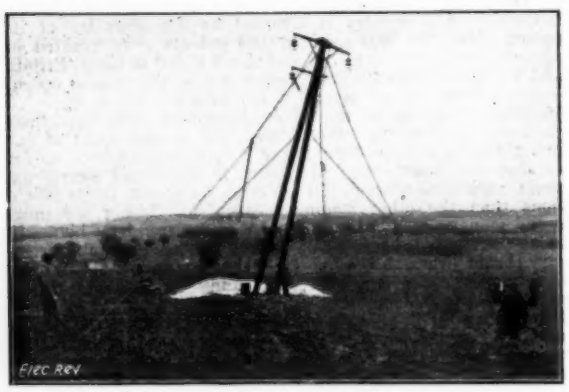


Fig. 2.—Pole being Erected.

It will be seen from the accompanying illustration, fig. 1, that main foundation timber baulks are provided on both sides of the pole legs, and that anchor baulks are secured at right angles to the edges of them. The main baulks are placed at the extreme ends of the pole butts, and galvanised wrought-iron tie-rods are fitted for transferring the upward pull on the legs to the foundation. The angle-iron tie-rods connect either the main baulks, or the anchor baulks, to the legs at a convenient height above the main baulks, and are below ground level. Bent metal plates of channel section are provided for transferring the compression load on the legs to the foundation, the plates passing over the top of the main baulks and underneath the pole butt. When excavating for the foundation the hole is undercut at right angles to the plane of the "A," and at each side, so as to receive the anchor baulks, which are fixed after the pole has been erected in the hole. Thus, the anchor baulks have above them solid undisturbed earth, with a consequently increased resistance to any over-turning tendency of the pole.

Tests on a 40-ft. "AnchorA" pole in comparison with an ordinary "A" pole, have proved the former capable of withstanding a load (applied 31 ft. above the ground level in each case) of 70 cwts., against 15 cwts. sustained by the "A" pole; it also withstood a load of nearly 40 cwts. without any signs of the foundation giving, while the ordinary "A" pole began to fail at 10 cwt. The poles were sunk the same distance in the ground, and the tests were made with them side by side in the same unturned earth.

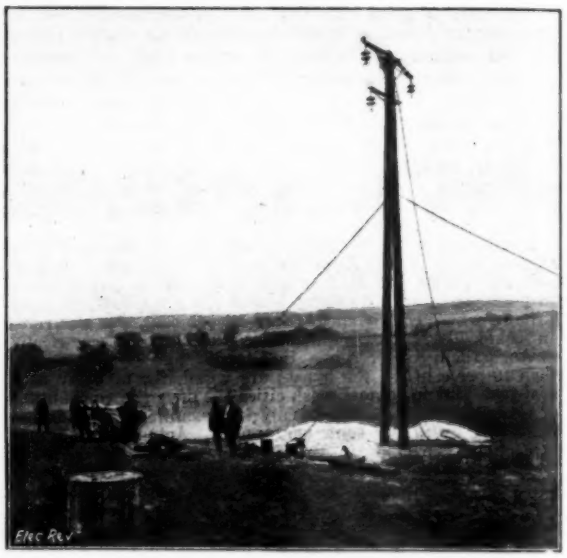


Fig. 3.—Pole Completely Erected.

The photographs reproduced show stages during the actual erection in September of an "AnchorA" pole near Cobham, in Kent, to carry a 0.15-sq. in., 3-wire, 33,000-volt line from the Bevans sub-station to the Medway river, which is being erected by Messrs. W. T. Henley's Telegraph Works Co., Ltd., for the County of London Electric Supply Co., Ltd. In fig. 3 a petrol-driven "Fordson" tractor, which is employed for moving tackle, will be noticed. A brief description of the pole was given in our issue of July 17th, 1925, p. 115.

Electrical Imports of British Malaya.

Below are given the values during 1924 and 1925 of the imports of electrical and allied material into British Malaya, together with a note of increase or decrease in the trade.

	1924.	1925.	Inc. or dec.
Wire and cable, insulated—	$	$	$
Total	1,029,000	1,517,000	+488,000
From United Kingdom ...	1,017,000	1,486,000	+469,000
„ Japan	1,000	5,500	+ 4,500
„ United States	9,000	2,000	– 7,000
Telegraph and telephone instruments and apparatus—			
Total	284,000	246,000	– 38,000
From United Kingdom ...	266,000	229,000	– 37,000
„ United States	9,000	5,000	– 4,000
„ Sweden	1,000	—	– 1,000
Electric lamps and parts—			
Total	156,000	86,000	– 70,000
From United Kingdom ...	66,000	26,000	– 40,000
„ Germany	21,000	*34,000	—
„ Italy	15,000		—
„ Holland	27,000		—
Electric lamp bulbs—			
Total	13,600	261,000	+247,400
From United Kingdom ...	—	90,000	+ 90,000
„ Holland	8,000	*94,000	—
„ France	600		

	1924.	1925.	Inc. or dec.
Batteries and accumulators—	$	$	$
Total	104,000	181,000	+ 77,000
From United Kingdom ...	45,000	55,000	+ 10,000
,, Japan	9,000	36,000	+ 27,000
,, United States	46,000	83,000	+ 37,000
Electric lighting accessories and fittings—			
Total	130,000	177,000	+ 47,000
From United Kingdom ...	91,000	110,000	+ 19,000
,, Germany	6,100	*24,000	—
,, Holland	7,000		
,, Japan	11,000	36,000	+ 25,000
,, United States	11,000	83,000	+ 72,000
Electrical goods and apparatus (not machinery) not elsewhere mentioned—			
Total	558,000	843,000	+285,000
From United Kingdom ...	442,000	565,000	+123,000
,, Italy	33,000	*82,000	—
,, Sweden	12,000		—
,, Japan	13,000		—
,, United States	34,000	140,000	+106,000
Electric generators—			
Total	102,000	43,000	− 59,000
From United Kingdom ...	86,000	34,000	− 52,000
,, France	4,000	*1,400	—
,, United States	7,000	6,000	− 1,000
Motors—			
Total	566,000	240,000	−326,000
From United Kingdom ...	275,000	150,000	−125,000
,, France	17,000	*1,400	—
,, Germany	22,000		—
,, Holland	9,000		—
,, United States	238,000	18,000	−220,000
Ignition magnetos—			
Total	40,000	22,000	− 18,000
From United Kingdom ...	6,500	6,000	− 500
,, France	5,000	*54,000	—
,, Germany	17,000		—
,, Italy	4,000		—
,, United States	6,000	7,000	+ 1,000
Other electrical machinery—			
Total	287,000	1,055,000	+768,000
From United Kingdom ...	261,000	804,000	+543,000
,, Belgium	3,000	*8,000	—
,, France	5,000		—
,, Italy	3,000		—
,, Holland	4,000		—
,, United States ...	2,000	57,000	+ 55,000

* From Europe as a whole—separate countries not specified in 1925.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. *No letter can be published unless we have the writer's name and address in our possession.*

Electric Fires for the Home.

I never look at a catalogue of electric heaters without feeling that until something very much better than is offered at present is put on the market there can be no real progress in domestic electric heating, and your "Domestic Electrification Number" bringing together, as it does, most of the makes impresses this feeling strongly.

Your article and the advertisement pages represent very fairly what is offered to the public, and after looking through the illustrations, is it too much to say that it would be hard to find anywhere an article of substantial price and offered as a first-class fitment in which there is so much flimsy appearance and "tin-can" construction and withal so little artistic merit? That is how it appears to me, and it would interest me very much if someone would tell me why it should be so.

The conditions the designer has to meet are very simple and if coal and gas engineers can meet them, as they do, electrical engineers should be able to do so also. I am aware, of course, that the absence of combustion makes lighter construction possible, but that does not make flimsiness permissible. In this connection, I was very much impressed a few months ago when I visited a large showroom of gas fires and saw how well the gas engineers had dealt with their problem. Their results are genuinely excellent. Strong stuff, they make, well made and of good appearance, and undeniably superior from every point of view to electric heaters comparable with them. They show the touch and the generous dealing of the experienced engineer and the design of the artist, but ours savour of the amateur or the apprentice draughtsman.

To indicate what I have in mind as essential in a good-class heater I would summarise briefly as follows:—

1. It must be artistic and properly proportioned to suit its design and the surroundings it will be in.

2. It must be designed for its purpose, that is, if it is intended to be an imitation coal fire it should look like one; if it is intended to be fixed in a fire grate it should be of a size and design to suit the mantelpiece and firegrate surroundings; if it is a portable heater it should be designed as such and should not be a would-be fixture with a handle on it.

3. It must be sufficiently strong and robust for household wear and tear and for handling by servants.

4. It must be in every way serviceable and safe, thus, for instance, lacquered polished sheet metal work should be entirely excluded, as also would be the little china insulators as brittle as biscuits.

In conclusion, there is the question of price, and here, again, the electric heater fails. I purchased a gas fire which, when it is lighted, looks exactly like a heaped-up coke fire and gives a fierce heat with no smell, and the total cost fitted in place and connected up was £2 18s., but the cheapest electric heater I would fit in my house costs £7 10s. and the circuit would cost another £1 10s., making £9 in all.

Fireside.

Belfast, *October 28th*, 1926.

British X-ray Progress.

We have read with interest your article "A Modern Radiological Department," and we must say that the execution of this department was evidently carried out with great skill, but what strikes us as being most astounding is that, however far we look ahead, it seems absolutely impossible to keep pace with the rapid advance in design and construction of apparatus.

It might be of interest to your readers to know that the latest in Potter-Bucky diaphragms is a flat diaphragm, as, against the curved one and of course the flat one is very much superior, and then the X-ray tubes are now made with their own protection round them, and this means that instead of having their heavy box which weighs anything from 30 lb. excluding the tube, the new tubes only weigh complete with their protection about 9 lb.

We mention these points as certainly of passing interest, showing how difficult it is for manufacturers in the X-ray field to keep pace with the rapid changes of ideas and improvements.

The "Solus" Electrical Co.
(*Eric J. Ward Watkinson.*)

London, *October 29th*, 1926.

Internal Communications.

Mr. Herbert G. White, A.M.I.E.E., writing under the above heading, says:—"While it is true that in a large business house, or a hotel, the intercommunicating telephone has been almost completely replaced by private branch exchanges installed and maintained by the Post Office, &c." Mr. White has evidently been sadly misinformed on this subject, and I can assure him that nearly all the large business houses in London have efficient private installations, installed and maintained by private firms. If he cares to look in the telephone directory or the "Buff Book" he will see the names of quite a number of firms which are busy all the year round carrying out this class of work. I refer to telephone contractors, who in nearly all cases keep *solely* to this branch of electrical contracting.

With regard to maintenance, he states that this will "Find work for his men at odd times between his larger contracts" (!) Mr. White might be interested to know that any decent firm of telephone contractors has its maintenance staff, who are responsible for this side of the business. I shudder to think what sort of service customers would receive if their installations were maintained in the way he suggests.

Intercom.

London, *October 25th*, 1926.

The Lightning Rod Act in Ontario, Canada.

The example mentioned by Mr. C. H. Brazel, of a fulgurite 30 ft. long, reported by Dr. Priestly in the Geological Transactions in 1790, is new to me. Though Dr. Priestly is mentioned in the report of the first Lightning Rod Conference, in connection with his committee work on the subject of lightning protection, no mention is made of his fulgurite, but possibly this is due to the fact that the importance of more detailed study of fulgurites was not then recognised. As I have not hitherto had an opportunity of seeing Dr. Priestly's original report, I refrain from comment at the moment, but beg space to reply to the deduction by Mr. Brazel that "this confirms the necessity for deep earth plates where the upper strata are of a non-conducting nature."

Given a building on non-conducting strata, protected by a conductor reaching from the lower conducting strata to a point between 1 and 20 ft. above the building, in accordance with the accepted mode of to-day, then when a flash occurs from cloud to earth, that flash is "conducted" only at the final extremity of its path. Conversely, if the flash is from earth to cloud, then it is "conducted" only at the beginning of its path. In both cases the "conduction" is only for a fraction of the length of the path, either at the beginning or the end, and Mr. K. Hedges states that this arrangement has given satisfaction.

If this is so, then also would equal satisfaction be attained by placing the conductor in any portion of the path other than at one of its extremities. If the lower end of the conductor did not reach down to the conducting strata, but

terminated near the surface in a non-conducting medium, then the protective device would have been moved from one extremity of the path to a point a short distance along that path, and a flash which struck the aerial finial of the conductor would pass out at the other end with exactly the same facility with which it entered.

It may be said that owing to the inefficient earth connection, side-flashing would be increased to the grievous detriment of the property. One may as well argue that owing to the inefficient cloud connection at the skyward end, the same thing happens.

The continuance of a lightning conductor to well-earthed strata increases the probability of that conductor being struck by lightning, consequently it increases the liability of damage to the property so protected, by means of side-flashing.

E. Isherwood.

Saltcoats, *October 25th*, 1926.

The B.E.S.A. Glossary.

Having missed the Review for several weeks, I was looking through the back numbers when I came across a letter from Prof. C. L. Fortescue in your issue of September 24th dealing with my British Association paper. In view of the appointment of a committee to consider the whole subject, I do not intend to enter into any general discussion, but the letter referred to leads me to suspect that there is some misunderstanding as to the grounds for my disagreement with the electrostatic definitions in the Glossary. Whether we employ the term "unit tube of force" for a tube having a cross section of 4π square centimetres where the electric force is unity, as is done by many physicists, or whether we adopt the modern electrical engineering practice of making the number of lines of force per sq. cm. equal to the strength of the field at the point, is a minor detail compared with the importance of using terms which indicate quite clearly whether they refer to the electric force or to the electric displacement or flux density. My criticism was directed mainly to the failure to distinguish clearly between these two magnitudes. Prof. Fortescue says that the B.E.S.A. unit tube of force is that used by a number of physicists, which is true, but the first of his list of physicists which I consult, *viz.*, Carey-Foster, says in italics that "The flux through a closed surface proceeding from a charge q inside the surface is $4\pi q$," whereas immediately following the definition of the unit tube, the B.E.S.A. Glossary states that "The total flux over a surface enclosing a charge is equal to the charge."

Many of the terms have been used in different senses by various authors in the past and none has suffered more than the word "force," but with the great development of high-pressure work, electrostatic problems have become so important to the electrical engineer that it is imperative that the nomenclature be simplified and standardised. Where the same term is used in both electric and magnetic fields, it should signify analogous conceptions, and where a graphical picture is employed, whether lines or tubes, let the name employed leave no doubt as to the magnitude which it is intended to represent, whether H or B in the magnetic or ε or D in the electric case. These considerations have guided me for many years in my choice of terms and I had noticed a gradual crystallisation along these lines in electrical engineering literature in recent years, but the B.E.S.A. Glossary came as a rude shock, not because of any different system of units, but because of the apparent absence of system and the general confusion between the different units, terms and conceptions.

G. W. O. Howe.

Glasgow, *October 28th*, 1926.

Relief Bolts and Flameproof Enclosures.

With reference to Mr. Huggins's letter in your issue of October 15th, it is no misrepresentation of the facts to say that the bulk of his article was devoted to the advantages of a particular form of protection which he favours. There is no harm in this, and had he confined himself to praises of his device I should not have encroached upon your space. However, as he has seen fit to decry another well-known form of protection, it seems desirable to point out the facts.

I cannot help coming to the conclusion that Mr. Huggins has very little experience of relief bolts or their functions. He says: "It has been amply demonstrated by tests made during the past 20 years that relief bolts do not provide the maximum pressure release. . . ." As relief bolts were only introduced in 1921 for the first time, I think it is clear that Mr. Huggins is under a misapprehension.

The remarks which he quotes on the subject of inertia are merely an expression of opinion on a theoretical point of no practical significance. Relief bolts allow a movement of 1/50th of an inch, and a multitude of tests have demonstrated conclusively that they prevent a dangerous rise of pressure. In these circumstances there is no more point in harping on the inertia which has to be overcome to move a cover 1/50th of an inch, than there would be in suggesting that because of inertia all circuit breakers are useless and only fuses, and a particular type at that, should be used. Inertia is of no consequence in the application of relief bolts, and no amount of argument can make it so.

In the remainder of his remarks Mr. Huggins is on even more dangerous ground. He suggests the use of a jointing material for flameproof enclosures, notwithstanding the objections to such a practice, *i.e.*, the possibility of the jointing being blown out in the event of an explosion and the possibility of jointing not being replaced when the cover is removed for any reason. In the next breath he says:—

"(*a*) Relief bolts would not hold the jointing securely, (*b*) they would cause a vacuum, (*c*) they would not cater for the normal breathing action of the motor."

In the first place I do not agree with the use of jointing for flameproof enclosures, and, secondly, I do not see Mr. Huggins's point in suggesting jointing to get a really watertight enclosure if at the same time he is advocating constant-aperture vents for the relief of pressure.

Relief bolts cannot cause a vacuum to form as, apart from the fact that very light springs are employed, the flanges of the enclosure are not ground valve seatings, but more or less coarsely machined surfaces which could not be made airtight without a great deal of trouble.

Finally, he says that relief bolts could not replace constant-aperture vents in cases where vents have been introduced for ulterior objects. I am able to agree with this contention, even though the logic is somewhat attenuated.

R. Amberton.

London, *October 27th*, 1926.

The Electric Vehicle and Charging Facilities.

On many occasions your journal has published articles on the selling of electricity to householders, and on the selling of aids to increased energy consumption. After all, though to the consumer the great advantages of electric cookers and such like over other methods are made the selling point, nevertheless, the ruling idea of the seller—if the seller be a producer of electricity—is that the more cookers, irons, fires, &c., sold the greater the load on the station.

We would suggest to these station engineers and their sales forces that they are missing a big market.

The electric vehicle does not enjoy the popularity it should, mainly on account of charging difficulties, nor is there likely to be any rapid advance until charging can be had conveniently in every town.

The station engineer can help the vehicle manufacturer enormously in this direction by offering to garages (or direct to the potential vehicle user if he has his own garage) charging plant on the same lines as he offers other apparatus—*i.e.*, simple hire or hire-purchase.

The vehicle-charging load during the day-time will be very small. Vehicles will require charging after the day's work, usually at an "off-peak" period.

As the smallest size of van takes approximately 14 units this potential load is not one to be ignored, and the price of a motor-generator set and charging plant is not greatly in excess of that of an electric oven or cooker, which has a considerably smaller annual consumption.

The small man who is prepared to buy an electric vehicle is often driven away by the prospect of having to buy charging apparatus. The availability of sets on hire would clinch such sales to the benefit of the vehicle manufacturer, the apparatus manufacturer, the electricity station, and (where the supplier is the local corporation) ultimately to the benefit of the rates.

The station engineer has hitherto ignored the "electric." In America, where the electricity companies lay themselves out for the charging of such machines they have derived considerable benefit. The total increased load in New York alone runs into some millions of units. The supply companies have their own garages where vehicles are charged, and they co-operate with the manufacturers in every way.

When the home supply authorities wake up to the fact that this load is there awaiting development, then more will be spent at home on vehicles, apparatus, and electricity, and less in America for petrol.

T. N. Cross.
(Electromobile, Limited.)

Otley, *October 27th*, 1926.

[There can be no doubt, we think, that the lack of charging facilities is the chief obstacle in the path of electric-vehicle development, and that the load obtainable is highly desirable on account of not only its magnitude, but also its incidence in off-peak hours. Load-factor improvement is of the first importance to the station engineer who wishes to cheapen the cost of supplying electricity.—Eds. Elec. Rev.]

The Tungstone Accumulator.

My attention has been drawn to the letter over the signature "J. S." in your issue of October 15th, regarding the Tungstone accumulator, and in particular his reference to your comments on page 386 of the Electrical Review.

I am afraid your correspondent does not see the significance of the tests made, any more than does "Vinall" who, wedded to his theory of double sulphation, is very inclined to leave his conclusions "in the air," so to speak.

In the last sentence that you quote of his, he asserts:—"Such a measurement does not, however, represent the ordinary service conditions." So far as car starting and lighting batteries go (and with these we are immediately concerned) it *does*, as most battery makers know; and "J. S." must not rely upon a mere assertion of Vinall's for any argument upon the merits of an accumulator.

The test we used, as any chemist will immediately see, was the only one with rizid datum lines; and the only one from which can be definitely calculated the real efficiency of the

paste and grid; and the suitability of the design for the purpose to which the cell is to be applied.

The test is eminently practicable, easily taken, and, being a replica of service conditions on the car, is in my opinion the best yet devised for starter batteries.

J. McD. Burnett.

(TUNGSTONE ACCUMULATOR CO., LTD.)

London, *October 23rd*, 1926.

[If the series of tests under consideration is examined, it will be seen that the capacity of the cell is continuously decreasing, and that if the series is carried far enough, the capacity will eventually be zero. This may represent the service conditions under which some starter batteries suffer, but surely our correspondent would not regard them as normal?

We suggest that the proper cycle of charge and discharge is one that can be exactly repeated indefinitely (subject, of course, to due allowance for wear and tear), and that the efficiencies usually quoted are based upon such a cycle.—EDS. ELEC. REV.]

The Salaries of Disabled Ex-Service Men.

With the approach of Armistice Day, I should like, once more, to draw attention to the deplorable conditions under which many disabled ex-service men are working on the staffs of some of the most successful firms in the electrical engineering industry. Many men of technical ability, occupying positions of responsibility, are struggling along on salaries of £2 to £2 10s. per week, regardless of the fact that their disablement does not in any way interfere with the proper carrying-out of their duties. Many firms who are proud of being on the "King's Roll" call for periodical returns of all ex-service men employed by them. To the directors and managers of these firms, I would suggest that when the next returns are made (or sooner if possible), the salaries of the disabled men should be ascertained, and should be reviewed where it is shown that the salary is not in proportion to the man's responsibility or qualifications. I have no doubt that the meagreness of some disabled men's salaries would make some directors and managers think awhile.

Arco.

October 30th, 1926.

Electricity Supply in Ireland.

Its Future Prospects The State Plan Analysed.

(*Abstract of Chairman's address before the* IRISH CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

IN his inaugural address as chairman of the Irish Centre of the Institution of Electrical Engineers, Mr. L. J. Kettle, M.I.E.E., M.I.Mech.E., city electrical engineer, Dublin, pointed out, *inter alia*, that the annual consumption of fuel in Ireland was equal to 7,600,000 tons of coal. Assuming that electricity would not displace the peat already being used, that the gasworks and railways would not be affected, and that electricity would merely be substituted for one-half of the imported coal used for industrial and domestic purposes, gave an electricity requirement of 1,000,000,000 kWh.

The basis for a supply of this magnitude was a national transmission and distributive network. If the population of the country increased even to the figure at which it was a century ago, 2,000 million kWh was no over-estimate. The general economic condition of the country must be favourable in order to reach that development, but even without any great change a very considerable outlet could be found for electricity if the State were prepared to finance the distribution network.

Ireland was practically a virgin country, inasmuch as supplies of electricity were virtually non-existent outside a few of the principal towns. There were in Ireland 151 electricity works, of which 104 were in the Free State and 47 in Northern Ireland. With the exception of those at Belfast and Dublin, all were small, many of them being private works for driving mills. Only 28 of them operated under statutory authority. The total output did not exceed 97,000,000 units per annum, including tramway supplies. Ireland's electricity consumption was easily the lowest in Europe with the possible exception of that of Portugal. Thus, the electricity used per annum per head of population was only 16 kWh in the Free State and 43 kWh in Northern Ireland, the population being 3,199,688 in the former and 1,190,531 in the latter on the 1911 basis; excluding the two capital cities, the consumption per head per annum was 6 kWh. Whilst regrettable, this fact was not without advantage, for inter-connection and standardisation thereby became simple technically; the d.c. plant was small, and necessary alterations could be made if financial assistance were forthcoming from the State.

It was somewhat of a misnomer to term the Shannon scheme a "power" scheme. It might be more justly regarded as a transmission scheme, comparable to the Swiss Central Board arrangement and the proposed British plan. It included a 100,000-volt transmission network to feed a 35,000-V net which, in turn, would feed a 10,000-V system. The network was to cover the entire Free State and linking it with a northern net would present no difficulty. The idea of supplying the whole Free State from one power station had been criticised on good grounds, but that was only a nucleus plan and not to be accepted as the ultimate arrangement. The electricity available would be (according to the experts' report):—

1st Stage—In a dry year 153,000,000 units, with an additional 90,000,000 units in winter and spring. In an average year 198,000,000 units with an additional 90,000,000 units in winter and spring.

2nd Stage—In a dry year 237,000,000 units with an additional 54,000,000 units in winter and spring. In an average year 237,000,000 units, with an additional 188,000,000 units in winter and spring.

This amount would be quite sufficient for the Free State for some time. If, however, the development expected took place, the Shannon supply would not be sufficient and other available water power would be utilised as well as fuel stations, at any rate supplementary to water; thus, the system would gradually be fed by several stations. It must be remembered that Ireland possessed vast potential power in her peat bogs, which would undoubtedly be utilised before many years had passed; a powdered-coal station in the Irish anthracite coalfield was also a possibility.

A transmission scheme had also been outlined for Northern Ireland, the principal station being at Belfast, possibly supplemented by another in the bituminous coalfield at Coalisland, water-power plant on the River Bann, and the Derry City works. Northern Ireland apparently proposed to proceed more gradually than the Free State; agricultural electrification was not regarded as being very attractive at the moment, and the proposals for the near future embraced only the joining of fair-sized industrial centres with Belfast. The main difference between the two schemes was the fact that the chief station in the north was coal-fired, whilst that in the south was to be driven by water. The necessity for a common system was emphasised by the fact that the second largest water-power site in Ireland, *i.e.*, on the River Erne, was on the border, the falls being in one State and the storage lake in the other.

Northern Ireland had not yet initiated a State scheme; the Free State had provided for one hydro-electric generating station and the high-voltage transmission system, but not for the distribution network as yet. If the provision of the latter was to be left to the general public, it could hardly be expected that an increased use of electricity would be great or sudden. Railway electrification was a remote possibility; apart from potential new industries and consumers, existing electricity undertakings would provide the bulk of the load for some years to come; the Dublin area at present used 75 per cent. of the Free State electricity, *i.e.*, 100 kWh per head per annum. Ireland was an agricultural country, and electrical progress in agricultural countries was slow if left to local initiative; the Free State had an agricultural population of two millions, and if the new network brought in 50 kWh per head per annum, the output stated to be necessary to put the Shannon scheme on its feet would have been achieved. Such an arbitrary calculation might be misleading, for in parts of the country coal was not dear in normal times, and in others peat could be had for the labour of getting it. The promoters of the scheme seemed to have anticipated that the new undertaking would be a commercial success practically from the commencement, which was rather too optimistic a view of the prospects. Of the total cost of supplying electricity to the consumer, the distribution cost was the governing factor, and the provision of the distribution network would prove to be the crux. It was here that the State could interfere most beneficially; having put its hand to the plough, it could not turn back. The State had anticipated the ordinary course of events by perhaps a dozen years, and consequently it must also anticipate events by providing distribution networks in districts wherein the financial results would not seem to justify private enterprise. Whether the State would engage in the business of electricity retailers, or elect to work through local organisations, was not yet known.

The venture had been subjected to considerable criticism, but now that the country had been definitely committed, the fullest co-operation must be forthcoming to make the scheme a success. If there was any business the nationalisation of which was justified, it was certainly that of electricity supply. It was only an extended, or "aggravated," form of municipalisation; and if a State scheme be as well run as municipal ones, there was no reason why it should not be a success; subsidies would, no doubt, be necessary. The utilisation of Irish water-power would be a national gain, inasmuch as it would render the country to some extent independent of imported fuel.

A second Shannon Power Bill was expected in the near future; probably it would deal with the supply and control of the entire electricity supply of the Free State. It was anticipated that the new Free State power would be available in about three years. The scheme might not be a commercial success in terms of hard cash for a long time, but that would not necessarily mean that it would not be a very real success.

Legal.

Disputed Lamp Credit Terms.

IN the Mayor's and City of London Court last week, before the Recorder, Sir Ernest Wild, K.C., the Metalite Co., Ltd., Fitzroy Square, W., brought an action against the Reliance Electric Maintenance Company, Queen Victoria Street, E.C., claiming £74 19s. 3d., balance of account due for electric lamps supplied. The delivery of the goods was admitted, but the

defendants set up the contention that at the date of the writ only £40 12s. was due. The balance was not due as the defendants were entitled to three months' credit under a verbal agreement. The plaintiffs denied making any such agreement. Asked by the Recorder to explain how it was that the defendant company had made payments sometimes four months after delivery of the goods, witness said that the plaintiffs had no choice in the matter as they could not get their money. The Recorder, after reviewing the evidence, said he came to the conclusion that the terms between the parties with regard to payment were that the defendant company was entitled to delay payment for goods delivered until the 20th of the month next but one to that in which the goods were ordered. In that case, he pointed out, the defendants' contention was right, and that only £40 2s. was due at the time of the writ, after certain small credits had been allowed. He therefore gave judgment for that sum, with costs. A counterclaim for further credits was filed by the defendants, and this the Recorder referred to the Registrar to be dealt with.

Claim for H.T. Radio Batteries.

IN the Mayor's and City of London Court, before the Recorder, Sir Ernest Wild, K.C., last week, Messrs. G. E. Ambatielo and Co., Ltd., Farringdon Road, E.C., sued the London Commercial Electric Stores, Ltd., Farringdon Avenue, E.C., for £52 4s., the price of one gross of 100-V h.t. radio batteries. The plaintiffs stated that in July last a telephone order was received from the defendants ordering one gross 100-V batteries at 7s. 6d. each. The defendants asked for a reduction in the price, and a concession of 3d. per battery was made. Later the defendants wrote alleging that the goods were not as ordered, and refused to accept them. For the defence, Mr. TAUSSIG said that he telephoned the order to the plaintiffs and stipulated that they were to have 6-V tappings. The 6-V tappings, however, only commenced after 54 V. The RECORDER said that he came to the conclusion that the defendants ordered batteries with 6-V tappings, and therefore, the plaintiffs had not delivered goods as ordered. He gave judgment for the defendants, with costs.

Rose v. Siemens Bros. & Co., Ltd.

THE Court of Appeal, consisting of the Master of the Rolls and Lords Justices Sargant and Lawrence, on October 29th dismissed an appeal by Siemens Bros. & Co., Ltd., from the judgment of Mr. Justice Russell in the Chancery Division, granting to the plaintiff in the action, Mr. Henry Rose, a declaration that he was entitled to an account of the commission which he alleged to be due to him from the defendants under an agreement dated February 29th, 1924, in connection with telephone exchange equipments, supplied to the Egyptian Government after that date, the contracts for which Mr. Rose alleged had been obtained through his instrumentality.

Messrs. Siemens Bros'. defence was a denial that Mr. Rose had anything to do with the procuring of the orders, and alleged that they had been induced to enter into the agreement by a false representation that Mr. Rose could render them material assistance in the development of their telephone business in Egypt and that in those circumstances they were entitled to repudiate the agreement which they did in April, 1924.

Mr. Justice RUSSELL held that there had been no misrepresentation by Mr. Rose and gave judgment for him with costs.

Mr. JOWITT, K.C., for the appellants, stated that he had fully considered the evidence and had advised his clients that there was no ground for appeal.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from October 27th :—

Superfone Maxum. No. 455,668. Class 8. Valve receiving sets, variometers, and fixed condensers, all being apparatus for use in radio-telephony.—H. D'Oyley Mantle, trading as the Radio Supply Co., Belwell Lane, Four Oaks, Warwickshire.

Sopranist (lettering and design). No. 472,887. Class 8. Radio-telephonic transformers.—S. Kalisky, Ltd., 75, High Street, Aldgate, E.1.

Memlock. No. 472,900. Class 13. Electric switches (ordinary) and electric fuses.—Midland Electric Manufacturing Co., Ltd.

Published Specifications.

Compiled expressly for this journal by patent agents. The name of the applicant's patent agent, if any, will be found on the printed specification. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1925.

8,932. "Arrangement of connections for the protection of power networks against overload." E. C. R. Marks (Voigt & Haeffner Akt. Ges.). April 3rd, 1925. (258,930.)

9,277. "Telephonic apparatus." A. E. White (Atwater Kent Manufacturing Co.). April 7th, 1925. (258,921.)

9,517. "Electrical transformers suitable for use with thermionic-valve systems." E. A. Graham (deceased) and L. H. Paddle. April 9th, 1925. (259,015.)

11,259. "Method of obtaining direct-current high-tension supply from direct-current electric light or power mains, or alternatively from suitably rectified and smoothed alternating-current mains." G. G. Blake and L. Russell-Wood. April 30th, 1925. (259,260.)

12,054. "Means for obtaining reduced voltage electric supply from a unidirectional current source for wireless systems and other purposes." G. G. Blake and L. Russell-Wood. May 8th, 1925. (259,262.)

12,258. "Thermionic-valve circuits." Hazeltine Corporation. February 27th, 1925. (248,311.)

14,429. "Method of and means for avoiding parasitic interference due, for example, to atmospherics in telegraphic systems employing synchronised transmitters and receivers, more particularly in wireless." C. E. Verdan. June 4th, 1924. (235,193.)

15,104. "Electric current breaker." P. Kapitza. June 10th, 1925. (259,272.)

15,136. "System for transmitting electrical impulses, particularly for use in automatic telephone systems." A. Barnay. June 11th, 1924. (235,578.)

15,990. "Testing devices for use in connection with wireless and other electrical apparatus." H. A. Gaydon. June 20th, 1925. (259,275.)

16,441. "Production of electrical insulating material and the like." H. Friedlander. June 26th, 1924. (236,224.)

17,050. "Means for maintaining in synchronism a number of electric motors." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). July 2nd, 1925. (259,285.)

17,171. "Methods of manufacturing moulded electromagnet-coil bobbins." S. Z. De Ferranti and Ferranti, Ltd.. July 3rd, 1925. (259,288.)

17,309. "Electrical control systems." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). July 6th, 1925. (259,291.)

17,350. "Directional aerial systems for use in wireless telegraphy and telephony." C. S. Franklin. July 6th, 1925. (259,294.)

17,358. "Electric furnace." J. K. Kiddle. July 6th, 1925. (259,296.)

17,394. "Means for charging electric accumulators from the generators of petrol-electric cars." W. A. Stevens. July 7th, 1925. (259,297.)

17,414. "Loud speakers." C. M. R. Balbi. July 7th, 1925. (259,298.)

17,434. "Frame aerials for use with radio-receiving apparatus." Igranic Electric Co., Ltd., and S. R. Wright. July 7th, 1925. (259,300.)

17,437. "Electric transformers." British Thomson-Houston Co., Ltd., and A. S. Holbrook. July 7th, 1925. (Addition to 241,843.) (259,301.)

17,469. "Electric protective systems." A. Reyrolle & Co., Ltd., B. H. Leeson, and R. W. Biles. July 7th, 1925. (259,304.)

17,552. "Electrolytic deposition of metallic coatings upon metals." A. C. Barlow. July 8th, 1925. (259,307.)

17,665. "Telephone systems." Standard Telephones and Cables, Ltd. (S. B .C. Scruby, B. A. Turkhud, and F. de Fremery). July 9th, 1925. (259,311.)

17,904. "Means for receiving and sending sound rays directionally." S. G. S. Dicker (C. P. Goerz Optische Anstalt Akt. Ges.). July 13th, 1925. (259,320.)

18,401. "Sound detecting devices." E. McCann. July 18th, 1925. (259,326.)

18,610. "Wave signalling systems." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). July 21st, 1925. (259,328.)

18,873. "Construction of vehicles." British Electrical Federation, Ltd., A. Twidle, and E. P. Worsfold. July 24th, 1925. (259,333.)

19,247. "Electrothermic indicators." T. Kalle. July 29th, 1925. (259,335.)

21,694. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. August 29th, 1925. (259,353.)

21,789. "Process for the extraction of tin from alloys containing lead by electrolytic means." H. Bondi, S. Bondi, and O. Neurath. September 19th, 1924. (240,147.)

23,076. "Electrodes for use in electric arc welding and the cutting of metals." Quasi-Arc Co., Ltd., and A. P. Strohmenger. September 16th, 1925. (259,365.)

24,812. "Electric motor control systems." G. H. Fletcher, R. Brooks, and Metropolitan-Vickers Electrical Co., Ltd. October 5th, 1925. (259,375.)

25,043. "Electric fans." S. A. Xipnas. October 7th, 1925. (259,378.)

25,443. "Insulators." Allgemeine Elektricitats-Ges. October 10th, 1924. (241,229.)

25,566. "Dynamo-electric machines." N. W. Gilbert and A. E. Jabet. October 13th, 1925. (259,380.)

25,696. "Dynamo-electric machines." English Electric Co., Ltd., G. Schroeder, J. C. Wilson, and L. Frape. October 14th, 1925. (259,381.)

25,697. "Dynamo-electric machines." English Electric Co., Ltd., and G. Schroeder. October 14th, 1925. (259,382.)

26,632. "Telephone systems." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). October 23rd, 1925. (259,391.)

26,673. "Containers for electrical appliances." Dubilier Condenser Co. (1925), Ltd. October 28th, 1924. (242,270.)

26,780. "Thermally-acting-excess-current time release for switch apparatus." International General Electric Co., Inc. October 29th, 1924. (242,273.)

31,191. "X-ray devices." British Thomson-Houston Co., Ltd. December 18th, 1924. (244,759.)

32,095. "Driving mechanism for electric railways operated by polyphase motors from a monophase line wire." Dr. K. Kando. March 7th, 1925. (248,710.)

1926.

2,552. "Alternating-current electricity meters." N. B. Coop and Meters, Ltd. January 28th, 1926. (259,444.)

3,732. "Cable-connecting device." P. F. Dufour. February 16th, 1925. (247,559.)

5,494. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. February 28th, 1925. (248,385.)

5,507. "Coupling devices for the starting motor-dynamos of motor-cars." Soc. Anon. pour l'Equipement Electrique des Véhicules. June 24th, 1925. (Addition to 237,541.) (254,258.)

5,711. "Electric stove." X. Waller and A. Schilter. March 1st, 1926. (259,453.)

6,223. "Electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). March 5th, 1926. (259,457.)

6,812. "Screening of coils carrying high-frequency currents." W. S. Worthington. March 11th, 1926. (259,459.)

7,654. "Electric boilers, liquid heaters, or the like." International General Electric Co., Inc. March 19th, 1925. (249,552.)

8,527. "Electrical apparatus for the elimination of aperiodic disturbances." H. L. J. M. De Regnauld De Bellescize. April 8th, 1925. (Addition to 226,784.) (250,564.)

9,329. "Variale electric condensers." Aktiebolaget Stern & Stern. November 13th, 1925. (259,481.)

9,850. "Electric lamps." General Electric Co., Ltd. June 29th, 1925. (254,270.)

12,074. "Control systems for multi-unit printing presses and similar mechanism." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). May 10th, 1926. (259,494.)

12,133. "Arc lamp for use in medical treatment." J. Bell & Croyden, Ltd., and I. W. Mason. May 11th, 1926. (259,496.)

12,677. "Apparatus for exhausting electric lamps and other objects." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 22nd, 1925. (252,368.)

13,965. "Manufacture of electrical insulators and other moulded articles." A. H. Brown and Siluminite Insulator Co., Ltd. July 8th, 1925. (Divided application on 17,544/25.) (259,505.)

14,359. "Wireless telegraphy and telephony." Marconi's Wireless Telegraph Co., Ltd. June 8th, 1925. (253,152.)

14,417. "Electric lampholders." S. Heath & Sons, Ltd., A. Tongue, and A. E. Mason. June 8th, 1926. (259,508.)

14,577. "Electrically-driven locomotives." E. C. R. Marks (Swiss Locomotive & Machine Works). June 9th, 1926. (259,509.)

17,633. "Spark-gap oscillation generators." Dr. G. F. Du Prel. August 11th, 1925. (Divided application on 20,171/25.) (259,521.)

18,422. "Controlling mechanism for alternating-current motors." British Thomson-Houston Co., Ltd. July 30th, 1925. (256,221.)

19,030. "Portable electric transformer outfit." Naamlooze Vennootschap Hengelosche Electrische En Mechanische Apparatenfabriek and P. H. A. Van Lis. July 30th, 1926. (259,525.)